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Tropical Crops

WORLD CROPS

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The International Journal of Agriculture

VOLUME 11, No. 12 DECEMBER 1959

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Photo: Plant Protection Ltd.

A young ratoon crop of sugar cane

Picture on silk

The *tatami*-maker, cross-legged, weaving his sweet-smelling rush mats. The lantern-painter, plying a bright-charged brush. Quaint wooden *kokeshi* dolls—and rich-costumed Kyoto puppets. Pottery and painted fans. Lacquer work and *satsuma*. Even in modern, industry-teeming Japan, the traditional arts apply. And not least in the manufacture of silk . . . the heavy, natural silk of the East. Despite the competition of synthetic fibres, silk production is still an important industry in Japan—and the production of mulberry leaves, sole food of the silkworm, is important for many farmers. Field after field is fringed by its row of mulberry bushes, and the crop ranks eighth in order in Japanese agriculture.

But what is food for one wanted insect is food also for the unwanted: mulberry leaves are equally as attractive to destructive pests as they are to silkworms, and until recently it was estimated that some 10% of the entire crop was lost annually to a variety of insects, particularly the voracious larvae of the mulberry pyralid moth (*Margaronia pyloalis* Walker). Many of these leaf-eating pests attack right up to harvest-time, and for fear of destroying the silkworms also, insecticides which might leave toxic residues cannot be used. '*Shikata ga nai*', the Japanese farmers used to say philosophically. 'There is nothing one can do about it.'

Today, however, the picture on silk has changed. Tests with Phosdrin, Shell's important and powerful new systemic insecticide, have shown that not only can a complete and rapid kill of the pyralid moth be obtained with concentrations as low as .025% to .05%, but that the mulberry leaves can be fed perfectly safely to the silkworms *within five days of application*. Phosdrin not only kills quickly—it is itself quickly dissipated into harmless compounds. This new Shell pesticide has a vast potential use on crops in all parts of the world threatened with close-to-harvest infestation.

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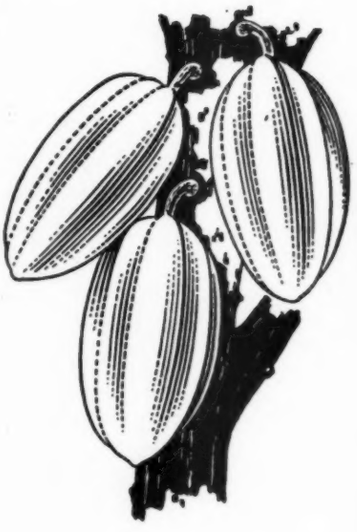

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Editorial Comment

A Saharan Green Belt?

SOME THREE MILLION square miles of the arid Sahara may one day become fertile land. Certainly many smaller arid zones, such as those in Spain, Israel and other rocky countries, might be made productive, and this may well happen in the next few decades because of the increasing need for more food.

This interesting speculation is based on the chance discovery by a chemical engineer in his garden on the Bagshot sands in Surrey, England. He applied vermiculite to a bare sandy area of heath and within a few months he had established a firm growth of grass.

Many gardeners are familiar with the use of this mica-like mineral for forming roots. Vermiculite is, in fact, often used in soil or sand to give a clean medium for root formation and to hold moisture and air, as well as in hydroponic trials with added mineral nutrients.

The gradual reclamation of the Sahara as a productive, fertile area could be effected by measures used in succession or applied simultaneously:

Firstly, the Sahara must be made to hold water. Vermiculite, used at, say, 9 tons to the acre, could be obtained from the nearby Transvaal and distributed by aeroplane or helicopter.

Secondly, water will need to be introduced and even the Sahara sun would have a hard job winning back this water once the vermiculite has absorbed it into the fissures of each granule.

This would be quite an achievement, as the diurnal range of humidity for the area – the difference between the wet and dry readings on a thermometer – is sometimes as much as 100°F.

Thirdly, a coarse grass, such as is sown on the sand dunes in Holland and East Anglia, must be established as a stunty growth. This will prevent the sand being blown away in desert storms and as the grass grows and dies a rudimentary soil containing humus will be formed and in time a green cover will be established as a green belt round the desert.

Another possibility involves the use of perforated polythene or PVC over the sand, pinned down at intervals. This is to prevent the sand being lifted by winds and the perforations are to allow the grass to come through and the soil to be aerated.

The provision of fresh water from the brackish well waters would appear to present a major problem, but we understand that at Tobruk an electro-dialysis stack built by William Boby & Co. Ltd. is already in operation and producing 55 tons or 12,000 gal. of fresh water a day from brackish desert wells. Several of these stacks, although expensive, could be placed strategically on the fringe of the desert to top up the main irrigation channels, which would, in fact, need to be pipelines to stop evaporation.

All this would obviously be a costly operation, but one well within the means of the oil companies who are establishing oil fields in the desert. The installations in these desert outposts would not only provide essential drinking water, but also water for the crop-growing area after a green cover of vegetation has been established and an adequate area reclaimed from the desert.

The urgent need for more food-producing land is forcing us to develop such inhospitable lands and the return in enhanced land values over a period of 50 years would be colossal. This has, already been proved in Australia (see WORLD CROPS, 1957, **9**, 110).

Barren Trees

IT IS rather surprising to hear that a development programme in Uganda includes the planting of considerable acreages of cocoa in Buganda province, where *robusta* coffee grows so well. Despite the advisability of diversifying production, this project would seem somewhat hazardous in view of past experience.

There were a number of large European estates scattered throughout Eastern and Western Buganda province, between 1900 and 1930, until Arabian coffee and Heavea rubber proved uneconomic. Some changed over to *robusta* coffee and others planted trial areas of cocoa of five and 10 acres or so on some of their most fertile soil, with bananas to give shade.

The cocoa raised from seed grew rapidly and well with plenty of shade and the soil was properly mulched with the old leaves, stalks and split banana stems, but the crop was a failure everywhere, as the trees would not bear enough fruit! After seven, eight and 10 years only one tree in five gave promise of economic fruiting and planters came to the conclusion either that there was insufficient rainfall or that the seed was unsatisfactory, or that there was some other cause.

Certainly the leaves of the older trees as they grew beyond the shade did not look healthy, for they curled on account of thrips attack. As often as not trees which produced the most flowers set no fruit; the flowers seemed to shrivel and persist like a thatch over the inflorescences, and it was suspected that the thrips were thereby given dry shelter while they fed on and damaged the young flowers.

Even in the Caribbean, where clonal cocoa is produced and planted, there has been the same puzzling problem of individual trees which do not and cannot be made to bear sufficient fruit. Where this tendency is acute, as in Uganda, caution would appear advisable. Perhaps the manufacturers of agricultural chemicals can provide an effective answer.

Land Reform in Asia

IMPORTANT LAND REFORM policies have been enacted and put into effect in many countries in southern Europe, Latin America and Africa, but the most significant and sweeping reforms of this nature are to be found in Asia, especially in under-developed and over-populated countries, such as India, Pakistan, Japan, China and Formosa.

The general trend of land reform in Asia has been in tenancy conditions, consolidation of fragmented holdings, breaking up large estates and redistribution of ownership to peasant cultivators. Thus in India, Pakistan, Japan and Formosa new legislation provides security of tenure, the right of compensation and control of rents, while onerous conditions, such as compulsory sale of produce to the landlord, are prohibited. In India abolition of *zamindari* landlordism has been enacted in order to establish peasant proprietorship. Somewhat similar steps have been taken in Pakistan. Under new laws in Formosa one-fifth of the cultivated area is to pass into the ownership of peasants. Land reform in Japan provides that cultivated land owned by absentee landlords shall be purchased by government for sale to smallholders.

Agricultural policy in Burma is directed to abolition of absentee landownership and improvements in conditions of tenancy, while improved tenancy conditions are also the objective in Thailand. Land reform in China abolishes feudal exploitation of land, limits the incidence of rent where tenancy is allowed, keeps the land tax within reasonable limits and prevents usury. The farmer is said to have benefited from these reforms, but the *per capita* availability of land after redistribution is so small that systems of consolidation, mutual aid and collective farming are said to offer advantages over individual ownership.

Landlord and Tenant

LAND REFORMISTS in Asia appear to infer that abolition of tenancy and the transfer of ownership to the cultivators will necessarily result in improved social and economic conditions. While ownership of the land he tills may confer some benefits and will add status to the owner, it will not necessarily enable him to procure larger crops or market them on more advantageous terms. He will no longer be able to rely on the landlord for credit and other help, while the moneylender and shopkeeper will not be more kindly disposed in the matter of granting credit. 'Debt', as Sir Gerald Clauson has written, 'in some communities has become such a normal part of life that existing debts are resented not so much because they stand between the farmer and freedom to lead a fuller life, as because they stand between him and the possibility of raising further loans'. This is a tragic state of mind, but often only too true. Education rather than ownership appears to be the real need of the cultivator.

It seems to us that in many Asian countries the present solution to higher production and the improved status and well-being of cultivators is to be found in improvements in the tenancy system rather than in extending land ownership. It should not be beyond the wit of man to devise and enforce on landlords tenancy systems suited to particular local conditions, which shall ensure security of tenure and fair terms to the tenant and a return to the landlord commensurate with the services he renders in provision of land and capital – risks inseparable in all agricultural undertakings being borne in equable proportions between the landlord and tenant.

The right to acquire the land freehold may well be added as an incentive to the tenant's industry and foresight. Such a course is more likely to result in improved husbandry and a higher standard of living for the peasant than many of the expedients, some of which have a political flavour.

There is no short cut to the betterment of the lot of peasant cultivators. The solution depends largely on the personal efforts of cultivators themselves – the will to become independent, for, as Erick H. Jacoby remarks, 'Land reform is not only a reform of the way land is held, but just as much reform of the man who tills the land'.

Operation 'Onion'

A 'COMBINED OPERATION' by the British Food Manufacturing Research Association, the National Vegetable Research Station, the Pickle and Sauces Section of the British Food Manufacturers' Association and the National Farmers' Union has triumphantly produced the perfect onion for pickling.

Over the last few years there has been a great deal of co-operative research between these bodies. Many varieties of the brown pickling onion, *Allium cepa*, have been tried on different soils in various parts of S.E. England, but principally in Norfolk, Cambridge and the Isle of Ely, to ascertain the effect of differences in soil and climate; different seedling rates and row spacings have been tried to determine what are the correct cultural conditions for producing a perfectly spherical onion of a uniform small size and having the correct texture and flavour.

The field was narrowed down to a few cultivars, the quality of which was recently assessed by a panel of experts. The top selections were processed under identical conditions and the final products were graded for colour, flavour, crispness and the absence of detached cores and bits. Thus have the ideal growing methods been determined and the 'queen' onion at last found.

We naturally enquired what was the need for this elaborate investigation and learned the astonishing fact that British pickles are not made from British onions – anything but. The onions used come mainly from

Holland, Italy and Egypt. About 10,000 tons a year, worth between £25–£30 per ton, are required to produce 35 million jars a year, the present output.

This obviously cannot be allowed to go on and the far-seeing British Government has recently imposed a seasonal protective duty of 4*s*. 3*d*. per cwt. so as to encourage the British farmer to ' grow more onions '. As a result, a number of small farmers have already entered into contracts with the pickle manufacturers and the commercial production of these onions has already started in trial plots. The growers have learned something about the crop, particularly with regard to correct harvesting and grading of the bulbs, and in all some 400 tons have been produced.

Yet Another Board?

NOW THAT the perfect onion has been found it will be possible to step up production on sound lines, but as more and more become available the present system of individual contracts will become increasingly troublesome. Sooner or later it will be necessary for the growers either to offer their produce through middlemen or to bulk and sell their graded onions through a co-operative selling organisation.

This problem is not a new one; small growers and smallholders the world over can never understand why they cannot sell direct to the large buyers – the millers and manufacturers – and thus obtain top prices if their produce is of top quality. Particularly in remote areas, either a middleman or some form of selling organisation is always necessary for the satisfactory disposal of small lots of produce.

What is FAO?

TWICE DURING our recent visit we were surprised to be asked by pilgrims to the Eternal City, ' What is FAO? ' The short answer is that the Food and Agricultural Organisation of the United Nations is the sheet anchor of our civilisation and deserves far greater support from the nations of the world than it is at present receiving.

To rectify public ignorance of the work of this important supra-national organisation, the Director-General, Mr. B. R. Sen, has been touring the capitals of Europe and has also visited the U.S.A. in order to bring home to the over-developed countries of the world the plight of the under-developed countries of the world. In his address to the members of the Royal Commonwealth Society in London he pointed out that in North America and Western Europe very high standards of living have been reached and are continually being improved, while in Asia, Africa and Latin America millions of people have to go without some of the bare necessities of life. ' The dilemma of wheat surpluses and under-nourishment ', he said, ' was one of the most extraordinary and baffling paradoxes of our time '.

Viewed realistically, he said more recently, few of the under-developed countries have succeeded in achieving a self-sustaining growth, despite the efforts of the past 15 years of technical advisory assistance and foreign aid . . . The recent declines in the prices of primary products (*i.e.* agricultural products) had caused greater losses to the poorer countries than all the foreign aid and technical assistance that they had received . . . and this, we comment, is occurring at a time when their needs are increasing due to population increases, but the responsibility for the failure does not rest entirely with the West.

As we have previously pointed out in these columns, the gap between the East and the West is steadily widening. While the West (including Russia) can afford to spend astronomical sums on defence and on research into the nebulous problems of outer space, the economic needs of inner space are being met with a few paltry millions. We would remind our readers that two years ago at the Dublin meeting of the British Association of Science Prof. P. M. Blackett shocked Britain with his recommendation for the expenditure of £1 thousand million a year in aid to the under-developed nations.

Speaking before the U.N. Economic and Social Council, Mr. Sen recently stated that ' the funds pledged for technical assistance work for the current year had been below expectations and that any repetition of the situation was likely to distort programme planning. It could also cause a loss of enthusiasm, which is essential to successful national efforts at improvement '. He concluded that a campaign of the scope envisaged would depend heavily on the support and co-operation of governments and of non-governmental organisations and it had been recommended that a special fund for the ' Freedom-from-Hunger ' campaign should be established, based on voluntary contributions from such organisations and from foundations and private individuals.

Severe Test

A GREEN-CROP HARVESTING competition was recently organised on a Sussex farm situated at the foot of the scarp slope of the chalk Downs where the soil was a slippery chalky clay. The crop chosen was marrow-stem kale, which is a particularly difficult crop to harvest mechanically because of irregular stem thickness and the varying elasticity of these stems.

Few fodder crops can compare with kale for ease of growing and high yield, but it is usually harvested by hand cutting for direct feeding to cattle rather than for ensiling. This was the view taken by the judges, who gave great prominence to a clean pick-up with a minimum of wastage and a minimum of soil in the cut crop. For direct feeding a fairly coarse chop with a minimum of pulped material was also preferred.

Taking these specifications into consideration, it was

not surprising that several well-known and highly successful silage harvesters were not seen at their best, as they are designed primarily for harvesting grass, cereal-legume mixtures, and grass and clover mixtures, which particularly need effective laceration to produce the best silage.

Furthermore, harvesters with in-line trailers did not fare as well as those with offset trailers, while one harvester with an unattached attendant trailer did very well indeed. This was because it is necessary to maintain a high rotor speed to cut the thick stems cleanly, to maintain vehicle speed and to avoid wheel spin if the assembly is to proceed uphill against this resistant crop on soft, slippery ground and when the trailer is carrying its full load of some 3 to 3½ tons of cut kale. With offset trailers, the side pull of the loaded trailer to some extent assisted wheel adhesion. The competition was thus a very severe test of those machines which were not specifically designed to deal with this particular crop.

Generally the results showed that a heavy crop of kale can be harvested mechanically and that, as a result of the experience gained in this competition, the cutting and loading of kale by hand will no longer be necessary. The Royal Agricultural Society of England, who organised the competition, and the manufacturers who supported it have rendered a useful service to the farming community. The experience gained with this difficult crop will lead to further improvements in design.

'*No,* no, *the dibromo-chloropropane formulation – can't you understand plain English?*'

Advice for Agriculture

THE GAP between the under-developed and the more developed countries of the world is widening and one reason for this would appear to be the lack of agricultural advisers with executive powers in the more backward countries. Thus in countries like Britain, Japan and America there is something like one agricultural adviser per 1,000 farmers, whereas in some countries there is an adviser for 10,000 or 100,000 farmers, and yet those farmers are in much more need of advice. In New Zealand farm improvement clubs have been formed; a group of farmers in a district form a club and choose someone who is very well informed technically and in other ways to act as adviser to that group.

If countries really want to bring about a rapid improvement in their agricultural industries, one of the most important things, according to Dr. H. A. Richardson, would be to increase the field advisory staff, and for getting things across and effectively carried out he considers that one adviser for every 50 or 100 farmers is needed.

It is apparent that the too rapid change-over from colonial status to self-government will inevitably result in an acute shortage of such agricultural advisers, and this may be one reason for the increasing gap between the more developed and the under-developed regions of the world.

Bharat Krishak Samaj

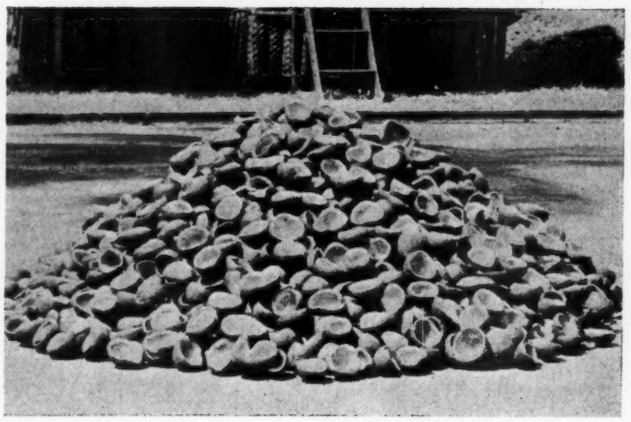
INDIA IS to be congratulated in taking the lead in the organisation of the First World Agricultural Fair, which has just been opened in New Delhi and will go on for the next two months.

The organisers are the National Farmers' Union of India, described in the vernacular as *Bharat Krishak Samaj*. The main objects of the Fair are to provide an opportunity for Indian farmers to view Indian agriculture in the context of the present state of world agriculture and the latest improvements in methods and machines. It will also provide an occasion to assess the comparative condition of agriculture in the constituent states of India and the progress made in community activities and major development projects.

India today is striving to achieve self-sufficiency in food production to meet the ever-increasing needs of its teeming millions and it is the hope of the organisers that by the use of new methods and modern machines India may progress more rapidly towards that goal.

Fourteen countries will be participating and three – U.S.A., U.S.S.R. and China – are to have national pavilions. Naturally, each Indian state will have one also in which all industries connected with agriculture and farming will be fully represented.

There are to be displays by folk dancers from the various Indian states to lend colour and charm to the Fair and visitors are expected to come from all parts of the world on this unrivalled and unique occasion.



A smallholder's kiln and the copra it produces. This inexpensive kiln can dry 1,200 nuts every two days

Good Copra or Bad?

Water the Key to Quality

F. C. COOKE

The Report of the Working Party on Copra Quality and Grading, which met in Colombo, Ceylon, from 17–25 August, 1959, is to be considered at the third session of the FAO Group on Coconuts and Coconut Problems. The Working Party elected Mr. V. L. Wirasingha, Director of Commerce in Ceylon, to be Chairman, and Governor J. Trivino, President of the Philippine Coconut Producers' Federation, and Inche Roesli Rahim, Chief of the Djawatan Kooperasi, Ministry of Commerce of Indonesia, were elected Vice-Chairmen.

THE Report of the Working Party on Copra Quality and Grading first considers the question of quality standards in production and then goes on to deal with international standards and the quality characteristics and grades desired by the copra traders and the oilseed crushers, and the need for incentives to encourage the producer to produce better quality copra is stressed. It is further observed that much of the work on copra quality and grading could be vitiated by serious instability in world market prices, since any effects which might result from the provision of monetary incentives or penalties for different grades of copra would be far outweighed by violent fluctuations in prices following sudden changes in the volume of supply or demand in international markets.

The Working Party recognises that the collection and critical examination of reliable information on domestic marketing systems was essential for effecting improvement in the quality of coconut and coconut products and a questionnaire is to be sent to the governments of coconut-producing countries.

Proposals for research and training under the Expanded Technical Assistance Programme are considered and in the Report the Working Party expresses its firm belief in the importance of establishing a training centre for copra preparation, and quite rightly gave this high priority among the measures which could improve the position of the coconut growers. It had been recommended at a previous session that the project should be carried out at a suitable location in the Philippines, but the Working Party still felt that it would be necessary for the expert to travel among the countries interested in copra preparation.

The most significant paragraph in the Report states:

> 'Of the three main analytical characteristics – moisture, free fatty acid, and oil content – moisture may be regarded as the most important factor determining copra quality. Nothing else, in fact, can compensate for inadequate drying at the source. The higher the moisture content, the higher the free fatty acid content of the copra which ultimately reaches the consumer. The higher the free fatty acid, the lower the yield of refined oil and the greater the costs of processing . . . Experts stated that such loss was considerable, and it was agreed that it was important to have precise data on the loss in weight which could result from insufficient drying'.

Discussion

There is nothing difficult about making good copra, but it is only too easy to make bad copra.[1] Copra is simply the dried meat of the coconut and the various methods of drying practised in different countries have been described and criticised.[2]

For the large producer who is in a position to deal direct with the merchant shippers there is usually an incentive in the form of a premium,

because the quantity of good copra he is able to offer is large enough and only involves a single transaction; for the producer of tiny lots, particularly those living in remote regions, far from the port of overseas shipment, there is seldom any incentive – on the contrary, there is every reason for him to offer a larger weight of under-dried copra to the local shopkeeper, to whom he is almost invariably in debt, or to the visiting trader, or even to his co-operative society, if there is one. Such under-dried copra is a normal trading hazard which is insured against by a standard low price, which allows for the subsequent cost of redrying, picking over and bulking into large consignments for sale either to the local mills or to the merchant shipper.

Appeals to producers, coupled with advice on how to make good copra, have always failed in the past, because only a small minority of the producers respond; similarly, a minority of the provincial traders can be induced to offer a small premium for these small lots of good dry copra, but the effort is always short-lived. Either the producer under-dries his copra to effect a quick sale, when prices are high or when he is in urgent need of money, or the local dealer loses interest because there is no direct advantage to him in encouraging the production of high-grade copra. The overall loss is to the country's revenue if the quality of the bulked product as exported is so low that it does not receive top market price or a premium, or it loses material weight in deterioration.

The position is really a stalemate, which education in improved methods of production alone cannot, and will not, rectify unless there is strong administrative action in support. The line that is often taken is to enact legislation establishing standard grades with some form of inspection, but particularly in the case of the larger countries with remote provinces such a system is doomed to failure. Under-dried copra is such an imponderable, unreliable product that the system will never be allowed to work in the provinces and it is too late to apply grading at the port of export after the damage has been done.

As emphasised in the Report, the water content is the paramount factor and its effective removal is the fundamental problem. *It is easy for anyone to produce a dry and stable product,* and this must be the first step in any campaign to improve production.

Thus there should be an absolute prohibition of dealings in under-dried copra, but there should also be an adequate period of warning to allow the trade to adjust its methods. There are no practical difficulties, as after the usual breaking test the sliver test[2] is quite conclusive confirmation of under-drying if the sample tested is large enough. There is no need for time-consuming analyses, except to obtain exact evidence and confirmation for purposes of a prosecution either of the buyer or the seller, or both.

Of course, not all the resulting copra will be white. There may be some discoloration due to delays in processing or to scorching, and the product may be over-smoked, so that some grading either by the producer or the buyer may be necessary. The main point is that such grading, whether it be official or unofficial, is being applied to a *stable* product. To sum up, the key to success is the effective removal of water.

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Coming Events

Grassland. – The 8th International Grassland Congress will be held at Reading, England, from 11–21 July, 1960. Enquiries and requests for application forms should be addressed to the Secretary, 8th International Grassland Congress, Reading, Berkshire, England.

Agricultural Exhibitions

India. – New Delhi will be the centre for a World Agricultural Fair to be held from 11 December–14 February, 1960. Further information from World Agricultural Fair, Exhibition Grounds, Mathura Road, New Delhi.

Holland. – The Farming Machinery Exhibition at Amsterdam is to be held from 18–23 January. Particulars obtainable from R.A.I. Gebouw N.V., Ferd. Bolstraat 155, Amsterdam.

Canada. – The Canada Farm and Industrial Equipment Trade Show will be held at Exhibition Park, Toronto, from 27–30 January, 1960. Further particulars from Canada Farm and Industrial Equipment Show Ltd., Willowdale, Canada.

Germany. – The 'Grüne Woche, 1960' – a town and country exhibition – will be held in Berlin from 27 January–7 February. Exhibition tickets are obtainable from M. Neven du Mont, 123 Pall Mall, London, S.W.1. Other enquiries should be addressed to the Berliner Ausstellungen, Eigenbetrieb von Berlin, Berlin-Charlottenburg 9, Masurenallee 5–15, Berlin.

Belgium. – The 40th International Agricultural Machinery and Equipment Exhibition will be held from 14–21 February, 1960. Details may be obtained from Societe de Mecanique et d'Industrie Agricole, 29 rue de Spa, Brussels 4.

France. – The Paris International Agricultural Machinery Exhibition will be held from 1–6 March. Details may be obtained from Union des Exposants de Machines et d'Outillage Agricoles, 95 rue Saint Lazare, Paris 9.

Italy. – The 62nd International Agricultural and Animal Farming Fair takes place in Verona from 13–21 March. Information may be obtained from the Secretary-General, International Agricultural Fair, Palazzo del Pallone, Verona.

Persian Gulf. – Agricultural Show and Trade Fair will take place from 31 March–7 April, 1960. Information may be obtained from Department of Public Relations and Broadcasting, Manama, Bahrain, Persian Gulf.

Leonard Hill to Visit Kenya

Mr. W. Leonard Hill, Chairman of Leonard Hill Limited, publishers of *World Crops* will be visiting Kenya in January and February. He will arrive in Nairobi on January 14 and will stay for four to six weeks. It is his intention to study agricultural and industrial affairs in Kenya and he will be pleased to meet Kenya readers of *World Crops.*

He can be reached through Group Captain C. G. Briggs in Nairobi, or Poste Restante, G.P.O., Nairobi.

The Luscious Mango

J. N. MILSUM,* F.L.S.

Included in the new series of World Crop Books shortly to be published by the Leonard Hill Technical Group is 'The Mango' by L. B. Singh, Ph.D., F.R.H.S., a distinguished Indian scientist who is Director of the Horticultural Research Institute of the State of Uttar Pradesh. This brief résumé by an expert on tropical fruits will give the reader some idea of the scope and contents of this informative book.

THE mango is an important cash crop in India and in a number of countries in South-East Asia. It is also grown in Egypt, parts of Africa, Hawaii and the West Indies. Efforts to popularise its cultivation are noted in Florida, Israel, tropical Australia and parts of central South America.

Nearly 70% of the total area under fruit in India is planted with mangoes to the extent of over 2 million acres. Its abundance in Bengal and the Deccan for over 4,000 years points to its origin in the Indo-Burma region.

Conditions for growth

The mango does best where the climate has strongly marked seasons, with flowering in the dry season. This characteristic is particularly noticeable in Malaya, where the mango is most successful in the northern states, which are less wet than elsewhere.

Temperature is the most important factor. The optimum growth temperature is said to be between 75° and 80°, although a wider range can be endured for limited periods. In the tropics the mango will grow up to 4,000 ft., but the temperatures at elevations above 2,000 ft. preclude its successful cultivation on a commercial scale.

Botany

The mango, known to botanists as *Mangifera indica* L., belongs to the family Anacardiaceae, which consists of some 64 genera, mostly trees or shrubs, often containing milky or acrid juice, which is sometimes poisonous. About 15 species of the genus *Mangifera* yield edible fruits, some of which, in addition to the mango, show signs of improvement through cultivation. In the Malay Peninsula alone there are at least nine species grown in village orchards, of which five are common.

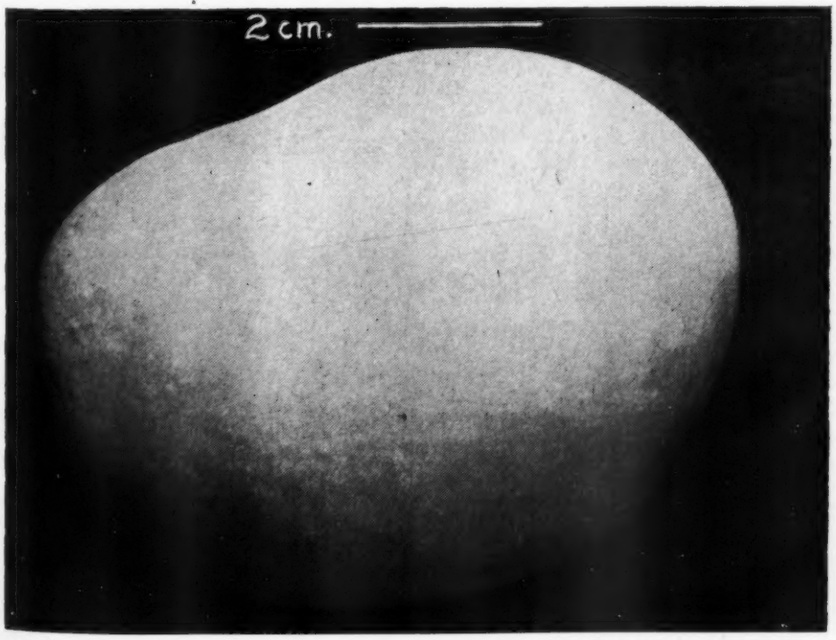
Harvesting mangoes

The flowering time, and consequently the time of fruiting, differs from country to country, and even from one locality to another in the same country. The mango fruit is a large fleshy drupe containing a fibrous stone.

Varieties

The numerous varieties of the common mango fall into two categories: seedling races, both wild and cultivated, and the clonal varieties, which are propagated asexually. The former are polyembryonic, but the embryos are highly uniform and perpetuate the characters of the parent seedling. A serious attempt is made in this book to dispel the confusion of varietal names and classifications of mango varieties.

There are a large number of named varieties in India. Named varieties are also known from the Philippines, Thai-



A yellow-skinned Indian mango, weighing about ½ lb. The flesh is a reddish yellow and has a pleasant aromatic flavour

* Formerly Deputy Director, Department of Agriculture, Federation of Malaya and Director of Agriculture, Seychelles.

Protecting the young plant against summer heat

land, Florida and elsewhere. In most mango-growing countries the people show great interest in their local varieties and regard them as superior to all others. The fruits of certain Indian varieties are indeed superb.

Breeding work

Hybridisation presents great difficulties and is time-consuming work. Since the parents are likely to be highly heterozygous, no genetical rule can be followed with any degree of accuracy. A special technique has been worked out for the crossing of mango flowers. Ultimate success is governed by the number of panicles involved, and so debudding is used to ensure that the breeder obtains one well-developed fruit from each panicle.

It is stated by the author that no commercial variety has so far been obtained from a planned artificial cross. First generation hybrids have been produced in India, Florida and Hawaii, but the factors constituting a desirable commercial mango variety are exacting. In addition to quality of fruit, hardiness and marked resistance to pests and diseases is most desirable.

Soil

Mangoes are grown on a variety of soils. In India some of the best orchards are situated in the Gangetic plains in the north, and also on the banks of other great rivers, with deep alluvial soils. The best orchards indicate that a definite correlation may exist between plant nutrients, including calcium, and yield. On the shallow soils of hill slopes in India mango trees grow to large size, but fruiting is reduced; soils which are deep, well drained and medium textured give the best results. The mango can tolerate a fairly wide range of soil acidity.

Propagation

Perhaps the best known method of reproducing the Indian mango is a form of aerial layering known as *gootie* layering. It consists of the careful selection of young shoots which have a ring of bark removed above the junction with the older stems. This is covered with clay soil, mixed with cattle manure, wrapped round with a piece of gunny sacking. The whole is then kept continuously moist in order to induce the formation of roots. This is often effected by the use of an earthenware jar containing water connected with a cotton wick. After sufficient rooting has taken place, the shoot, together with the ball of clay intact, is detached from the parent tree and potted. The young plant is then kept under shade in nursery conditions until sufficiently established to be planted in the field.

Recently another method has been introduced: vigorous growing shoots, one to one and a half years old, are selected and a ring 2 in. in width, just below a leaf bud, is cut and the stem ringed. A rooting medium, such as moss, capable of holding moisture is placed around the girdle and wrapped with suitable material, such as transparent aeroplast, which after watering retains moisture. The process of rooting, often assisted by hormones, may readily be watched from outside and under suitable conditions the ball of moss becomes filled with roots within two months. The layer is then detached with a sharp knife, with several cuts in instalments, at the stem below the plastic covering. After separation the cover is removed and the rooted plant transferred to a large pot containing good soil.

Other means of asexual propagation in use are a large variety of methods of graftage, including budding. A popular method of grafting is inarching. This operation is timed to coincide with the growing period of the tree, when sap flows freely and helps the rapid healing of cut surfaces. The shoot, while still attached to the parent tree, should be grafted on the seedling stock. Thus the selected shoot has a good chance of becoming attached early to the potted seedling. Subsequent treatment consists of severance from the parent tree and nursery treatment before planting in the field.

Shield budding is commonly used in mango propagation in Florida, Hawaii and the Philippines. Budwood, when taken from one country to another and

Spraying a mango tree against mango hopper using a telescopic lance

Left: *Balling a mango plant.* Right: *Method of packing mango grafts*

carefully treated and wrapped in plastic bags, has proved as serviceable as material freshly detached. Rapid transport by air has made passage over great distances practicable and should facilitate world distribution of the best mango varieties.

Planting

A commercial mango orchard in India needs to be irrigated. Thus the site selected should not only have good soil, but be at a proper level. Levelling may be necessary and some surface drainage to prevent standing water and waterlogging. The irrigating water should be led down a gentle slope into blocks of convenient size, ranging from one to 10 acres. Deep ploughing and harrowing are done in order to destroy weeds and encourage good rooting.

As is usual with tree planting, the usual spacing arrangement may be square, triangular or on the contour. The square system has advantages in that criss-cross inter-cultivation is possible and each tree has the maximum room for development. The triangular system at the same spacing will accommodate about 15 more trees per acre than square planting and so allows the maximum use of the land. On sloping ground, contour planting is advisable to prevent erosion.

In India the spacing usually allowed is from 30 ft. to 40 ft.; seedling trees require more room and at least 50 ft. each way is allowed (18 plants per acre). In parts of India windbreaks are necessary and a variety of trees used to lessen the efforts of high winds and extremes of temperature.

The actual work of planting calls for care. Pits 3 ft. square are excavated and the soil extracted is placed in two heaps, *i.e.* topsoil and subsoil, and allowed to weather. After a month or so the pits are refilled with the bottom soil uppermost. In addition, a mixture comprising compost, ash and superphosphate is added to the soil before replacement.

Transplanting is done during the monsoon months and when the mango plants are not in active growth. In general, inarched plants are mostly planted by growers, though in dry areas seedstones are commonly sown direct in the field. The seedling trees raised *in situ* are then budded or grafted with clonal material when they reach the required height and age.

After-care

The young mango is a demanding plant. Immediately after planting much care is required in watering and providing protection from extremes of weather. Later, as the plant develops, irrigation, manuring, training, light cultivation and protection from pests – all need attention.

Grafted mango plants often produce flowers a year after planting and early deblossoming then and until they are at least four years old is considered necessary to encourage vegetative growth. As with all tropical fruit trees, little pruning is usually necessary beyond the removal of dead or unwanted wood, as most Indian varieties form a symmetrical branching head naturally. As the trees grow tall lower branches are gradually removed to admit air and light and facilitate field cultivation.

Yields

It is stated by the author that five-year-old trees bear 15–20 fruits and the crop thereafter increases annually. At 10 years the crop may be 400-600 fruits, gradually rising to 2,500 fruits per tree after the twentieth year. After the fortieth year a decline in crop may occur.

The mango is an irregular bearer; a year of heavy or medium crop is known as the ' on ' year, whereas the

year when no crop is produced is the 'off' year. In northern India the fruiting rhythm may be almost bi-annual.

Manuring

In India manuring of mango trees was given little attention until about 1916, when organic manures began to be used. This resulted in more attention being given to the manuring of planting holes. Quite large applications were often given – in South India as much as 80 lb. of farmyard manure per pit.

As the young trees start to grow, and for the first year of growth, 1 lb. of complete inorganic fertiliser is recommended, the amount being increased to 3–4 lb. per tree by the end of the third year. In Florida micro-nutrients, such as manganese, copper, zinc and boron, are used at rates varying from 10–100 lb. per acre.

Diseases

The mango – both tree and fruit – is liable to a number of diseases. These diseases appear as anthracnose, blotch, dieback, necrosis and several forms of rot; they may take a heavy toll and in some instances have resulted in complete loss of crop.

Fungi cause the greatest number of diseases, whilst virus so far has resulted in little damage. Most of the diseases can be controlled by chemical spraying or dusting, but preventive measures, *i.e.* orchard sanitation and protective coverings of fungicides, check their incidence. Bordeaux mixture is recommended and widely used.

Pests

There are numerous insect enemies of the mango, and in particular termites and stem-borers may wreak havoc. Three species of jassids, known as mango hoppers, may cause serious damage to the crop in India and elsewhere. These excrete a 'honeydew' secretion which may harbour sooty moulds and damage the foliage. Recently DDT, applied as a wash, has been used against hoppers with success.

Scale insect attacks are reported from almost every mango-growing country and there are 62 separate species. Termites may cause great damage to young plants up to about four years old. An effective protection is stated to be 20 lb. of chlordane 5% dust per acre injected in the soil below the trees.

Plant parasites

Plants of the family Loranthaceae are the only common parasites of the mango tree and in northern India may infect 60–90% of the trees in a grove. As in the case of the common mistletoe, these semi-parasitic shrubs throw out haustoria which penetrate the branches of the host plant.

In several species adventitious roots grow externally along the stems of the host and give out suckers which penetrate the bark. Such parasites have a most deleterious effect on the trees and it is essential to eradicate such growths by severance below the haustorical system.

Utilisation and marketing

The luscious mango fruit does not retain its characteristic fresh appearance for long, nor does it keep well enough for transport over long distances. The result is the bulk of the crop is consumed fresh in the locality of production and at the peak of the harvest large quantities of fruit may be wasted.

Efforts have been made to preserve the fruit both by chilling and by freezing. The results show that mangoes may be kept for a time in cold storage, but must not be frozen.

Many attempts have been made to export the fruit and consignments have been received both in London and New York. In time it is probable the problem of marketing this delicious but delicate fruit overseas will be surmounted. Meanwhile sweet mango chutney and mango jams and jellies are already available for domestic and export consumption.

Rubber in Dominican Republic

A coffee and rubber plantation in the Dominican Republic. Excellent results have been obtained by growing these two crops together

After a very successful pilot rubber plantation scheme conducted by the Dominican Republic Department of Agriculture since 1952 in the Samana province, a full-scale effort to establish a rubber industry has been announced.

An initial planting of 67,000 trees is planned for some of the areas of heaviest rainfall in the Republic. Planting is to be carried out at 298 trees to the acre and average annual production is expected to be 3,000 lb. per acre. The varieties being used are GB 21, GA 352, GB 31, GA 1094, GB 37, GA 1026, GA 1279 and GA 1301.

Labour is not expected to be a problem, as it is intended to continue a policy of encouraging farmers to plant rubber in conjunction with other crops, such as coffee, bananas and yucca.

Coffee Production in India

India and the World Market

S. RAMANATH

Photo: Government of India

Harvesting coffee berries in an Indian plantation

Up to the close of the 17th century the world's entire, although limited, supply of coffee came from the Yemen, where the celebrated Mocha coffee was produced. Today there are a dozen countries, including India, at present producing coffee in excess of world demand and there is a considerable surplus overhanging the market.

THERE is perhaps no section of India's economy that owes more to British initiative and commercial enterprise than the plantation industry. Coffee was first introduced into India during the early part of the 17th century, and it was cultivated for over 200 years as a village crop until the British introduced the plantation system during the second half of the last century. It was in 1799 that its possibilities as a commercial crop were first appreciated by the East India Company and an experimental plantation was opened in Tellicherry, South India. Organised plantations sprang up along the slopes of the Western Ghats and by 1872 India was exporting about 25,000 tons of coffee.

Thereafter there followed a series of reverses, such as: the attack by the leaf disease, *Hemileia vastatrix;* then by the coffee stem borer; and, finally, the economic depression of the thirties, bringing with it the slump in coffee prices. These seriously crippled the industry and resulted in the abandonment of nearly a third of the area under coffee. The setting up of the Coffee Market Expansion Board in 1940 turned the scales and started a new era of prosperity and expansion for the industry.

Location and extent

The coffee estates are mostly situated in the hilly regions of the three states of Mysore, Madras and Kerala in South India, which have temperature and rainfall conditions favourable to the growth of the plant. It is estimated that the capital invested in these estates is over Rs. 150 million and that the average value of the annual coffee crop is over six crores.* These estates give employment to over 160,000 labourers, besides those engaged in the transport, curing and marketing of coffee in India.

Varieties grown

The species of coffee principally grown in India are the *arabica* variety, which is noted for its quality, and the *robusta;* the area under *liberica* coffee is negligible. The major part of the acreage is under *C. arabica*, being 167,321 acres out of a total of 252,686 acres in 1945–55 (*vide* Table 1). However, the last 15 years have seen a substantial increase in the area under *C. robusta*, which is preferred for its comparative resistance to pests and diseases and high productivity.

Coffee is prepared for the market either by the wet, or washing, method, resulting in ' plantation ' coffee, and by the dry method, producing what is generally called ' cherry ' coffee. After the estate processing is over the beans are sent to the curing works, where they are further dried, hulled, graded and hand sorted for removal of defective beans. Standards for sizing and sorting, as prescribed by the Coffee Board, are followed. Sometimes this is done on the estate.

* Crore: 10 million rupees.

Coffee seedlings being transplanted in a South Indian field

Mounting yields

The most outstanding fact about the coffee industry in India is that production has doubled in five years. The weight of the crop has increased from 21,235 tons in 1951–52 to 42,000 tons in 1956–57, which was the largest ever harvested in India. It is further anticipated that the 1958–59 coffee crop will be even higher and may exceed 50,000 tons.

Planters hold the view that for the next few years the crop will show further spectacular increases. This is because the acreage between 1947 and 1957 was increased from 216,916 to 260,406 acres and improved cultivation methods are yielding encouraging results. For example, last year an estate belonging to one of the large planting companies achieved a record crop of 2,000 lb. per acre, as against the overall national average of 376 lb. per acre. Several other estates are also producing heavy crops.

There were two contributing factors to these spectacular results: one was the adoption of modern methods and manuring; the other was the progressive introduction of high-yielding strains. Planters who were once considered to be reckless in their expenditure on crop spraying and in adopting modern techniques are now regarded as leaders and pioneers.

Planning and marketing

As soon as the Indian Coffee Board was reconstituted under the amended Act of 1954 it gave its attention to a planned development of the industry. The first plan drawn up in 1946 is interesting in the modest targets set before the growers. It was intended that within the first five years an annual production of 34,000 tons would be achieved. Even while this plan was being debated it was exceeded, for the planters produced 34,475 tons in that same year; they went ahead and produced 42,000 tons in the next year and 43,000 tons in 1957.

All coffee growers are now under a statutory obligation to deliver their entire crop to a pool administered by the Board and the Marketing Branch of this Board, attends to the sale of coffee. A large number of depots have been established in the coffee-growing areas, so that the small grower can deliver his crop without having to carry it over a long distance. The crop

Coffee being dried in a coffee factory

so collected is in due course transferred to the pool agents for curing, bulking, blending and storage. The proceeds of the sales are distributed among the growers, according to quantity and quality, after deducting marketing expenses.

Future policy

The growers have been demanding a revision of the Board's marketing policy in view of the anticipated increase in production, for there is now a considerable surplus over domestic consumption, for which a market must be found.

The Plantation Inquiry Commission attempted to estimate what would be the probable requirement in coffee production on the basis of its estimates of consumption. Its plan provided for 280,333 acres by 1971, with an output of 45,000 tons. It suggested a reduction of 18,578 acres under *C. robusta* and an increase of 52,611 acres under *C. arabica* on the 1952–54 acreage, with a net addition of 2,270 acres each year from 1956 onwards. The planters have, however, reached the Commission's target within two years and have already added 14,000 acres to the area under coffee.

The main recommendations of this Commission were: the creation of a Replanting Fund to be contributed to by every estate of 25 acres and over; regulation of area under cultivation; control by an independent expert body of the price to be paid to the producer; the handling of all exports by the Coffee Board; rational distribution of profit; and the adjustment of the excise duty on coffee, according to market price.

The main problem is the wide disparity in yields between efficient large growers and the small growers. The national overall average yield was 376 lb. during 1957–58. The large estates of over 250 acres obtained 672 lb. per acre, as against an average of 220 lb. for small growers with less than 100 acres. If the small growers' yields could be raised to the present national average, the total Indian output would easily reach 52,000 tons. Considering the progress made in recent years, the chances of the production rate rising during the next five years is quite feasible.

Although consumption estimates are largely in the nature of speculation, a total internal absorption of 38,000 tons by 1962 appears to be highly improbable. Today domestic consumption is over 25,000 tons, as compared with 8,000 tons in 1940, and during the current year India exported nearly 15,000 tons. The net annual surplus available for export by 1962 may be over 20,000 tons and the industry may be faced with a difficult problem.

The immediate need is to export as much as possible to obtain much-needed foreign exchange. There is a surplus of coffee overhanging the world market and consequently a price recession has set in. In a falling market it is on quality that Indian coffee can hold its own, and the world can be assured of a steady supply of India's superior grades of coffee at competitive prices.

Table 1
Acreage under coffee, 1945-55

State	*Number of estates*	*Acreage planted*		
		Arabica	*Robusta*	*Total*
Mysore	12,430	101,370	43,360	144,730
Madras	19,763	64,286	38,493	102,779
Kerala	7,196	1,665	3,512	5,177
Totals ..	39,389	167,321	85,365	252,686

Left: *The forest floor in the making* Right: *Within 10 years the trees have produced a fertile soil.*

Reclaiming Gravel Lands

N. L. GOODLAND

An abandoned gravel quarry is normally classified as wasteland, as it is useless for agriculture. In this article the author describes a method of reclamation by conifer forestry.

AFTER gravel extraction has taken place a farmer naturally will consider the possibility of restoring the area by direct attention to the quarry bed, but success will depend largely upon how much topsoil can be returned from adjacent areas. There is unlikely ever to be enough to ensure success, and even if the available topsoil is deep the cost of its removal and re-laying it is such that quarrying underlying gravel is then not a commercial proposition.

The problems of drainage, frost pockets, acidity and how to build up humus are general to such areas. By direct farming, with circumstances at their most advantageous, an average standard of recovery can be hoped for in from seven to 10 years.

Conifer forestry

In the Hampshire Test valley one method of reclamation is by a short period of conifer forestry, with the object of creating soil conditions suitable for agriculture. This takes longer – a period of about 20 years. At the end of this time two courses are possible for the owner: he may clear profitably and start farming, or he may have reached a point where it is more profitable to continue with forestry with a view to the subsequent establishment of hardwoods.

The conifers most used for this work are Scots pine, Corsican pine and larch. These seem to be the hardiest and are normally the most deep rooting. They are able to establish themselves upon old quarry beds

Establishment of Scots pine in a loose gravel soil. Note the sprigs of wind-sown birch among the stones

Two-year-old Scots pine in the nursery ready for transplanting

where there may be no returned topsoil at all and can survive the most disagreeable conditions. They may be even sown directly in seed-lines upon such beds with success.

The usual practice, however, is to plant 'two-plus-one' transplants – young trees reared for two years in the forest nursery, with one in the transplant bed to ensure sound rooting and therefore a good 'take' in the plantation. The planting distances are lines 2 ft. apart, with the plants 2 ft. apart in the lines. Their establishment is aided in the Test valley by encouraging the growth of wind-sown birch, which mothers both soil and transplants by producing a prolific yearly leaf-mould harvest.

One point needs careful watching. The tendency in all old quarry beds is to accumulate acidity, and with nothing done they pass the optimum condition, and the activity of micro-organisms and fungi in breaking down humus ceases within a period of about two years.

In practice lime is rarely used as a correction. The practical difficulties of supplying lime in sufficient quantities upon loose and, in places, saturated soil surrounding areas of flood and water are obvious, and since conifer forestry itself solves the problem the expense is not justified.

The quick establishment of the plantation is the first problem. Transplants have often to be put in before the soil is properly settled and during the first two years there must be a regular task of uprighting and firming any transplants toppled by the wind. Such a soil is particularly subject to lift by frost, exposing root systems and causing casualties which have to be replaced. Drainage problems are initially dealt with by run-off systems placed round the outside of the quarry beds, with trenches leading away.

After the establishment period is over the growing forest itself takes over such problems from the forester. Conifers root well down and as they break up and crumble the lower pan, not only does standing water gradually disappear, but the aeration and porosity of the soil is improved. Fermentation of natural humus is therefore not arrested; acidity is checked and stabilised, and the necessary work of micro-organisms and fungi can proceed with the gradual build-up of the forest floor.

This 'mycorrhizal relationship', readers are reminded, occurs by reason of the mycelium of certain soil fungi invading the cells of the root hairs of certain plants. The nutriment for the fungi is derived from humus. When the fungus mycelium invades the root cells the plant or tree absorbs nutrients, the fungus also deriving some benefit from the plant roots, thus completing the symbiosis.

Such symbiosis requires the right type of humus. Thus conifers grown upon land recently used for agriculture are notably pale in needle colouring and are more prone to disease than those grown upon more suitable soils. Further, for intensive conifer growing, as, for instance, in a forest nursery, even upon forest soils, originally developed for hardwoods, inoculation with humus from conifer areas is necessary. It is believed that on poor soils, plants maintain their full vigour and health only with the aid of active mycorrhizal symbiosis

A practical example

One interesting example is the reclamation of an area near Romsey – the old Southwestalls quarry. Previous to quarrying, this was only third-rate grazing land with a foot of topsoil overlaying an average of 8 ft. of gravel, with yellow clay below. After quarrying, topsoil was returned, but not enough to cover the whole area. Sixteen acres were planted with Scots and Corsican pine and this plantation is now 10 years old.

Drainage problems were partly solved by encouraging the formation of ponds and lakes, which become smaller year by year as the root systems of the plants go deeper. There was widespread frost lift during the winter, with long periods of dry gales experienced during the following spring. The competition for plant nutrients by the grass was also severe.

These factors together resulted in losses as high as 75%. None the less, the 25% securely established showed that replanting would be worth the attempt, and this was done. The

A reclaimed gravel area with well-established 10-year-old Scots pine

following two winters being less severe, it was only necessary to sow gaps left by normal casualties with Corsican pine.

Rate of recovery

In this case it needed eight to 10 years for the conifers to change to a healthy deep green, to reach a height of 10–15 ft. and to develop exceedingly good 'bushing'. This, in the view of the forester, gives a fair indication of the length of time needed before the mycorrhizal relationship is such that conifer growth is at its best. This naturally varies from quarry to quarry, but with no precise figures available 10 years is regarded as the practical working period, according to foresters engaged in this work.

This example shows, therefore, that within 10 years the conifers stand upon an area of good soil of their own making; the root systems are well down in the clay, breaking it up, and, as the photograph clearly demonstrates, have already transformed the clay from its original sterile condition to a state of good fertility.

On return of the area, when cleared, to agriculture the main disadvantage encountered is some acidity, but it is no longer so serious that it cannot be corrected by normal application of lime. The subsequent establishment of hardwoods upon cleared areas in the conifer plantation does not present any difficulty.

Photos: T. Viney

This sub-tropical variety of sugar-cane in Spain grows to a height of about 12 ft.

Heavy wooden harrow drawn by bullocks is used to break up the soil

Spanish Sugar Cane

MARY R. BULL

SUGAR-CANE is widely grown as a plantation crop in tropical and sub-tropical regions, but it is grown only in one place in Europe – in southern Spain. The particular area is a strip, about 200 miles long, on the 'Costa del Sol', near the port of Malaga, about 90 miles north of Gibraltar. Most of the sugar fields here are owned by villagers, who combine farming and fishing.

The sandy soil which lies between the 3,000-ft. high barren ranges of mountains and the beaches is intensively cultivated. The area under cultivation cannot be extended because the mountains come to within a mile of the shore or even drop sharply into the sea. Terraces have been cut into the hillsides and built up with stone walls here and there, but the mountains are generally too steep and rocky. Sugar-cane is also grown along the narrow strips on each side of rivers which run in the deep valleys between the mountains.

Because the area available is limited in this way, there is little reason to use swift modern machinery, and methods of cultivation are extremely primitive.

The slow bullock-drawn iron ploughs still used are fast enough to prepare the small plots and are cheap to operate, as the oxen provide manure and are fed on the crop residues. The empty fields are ploughed for new planting in December and later a heavy wooden harrow, on which the driver sits, is pulled over the soil to break it up. Large wooden carts, with a light fibre matting superstructure, bring cattle and horse manure to the fields, after which the slips are planted.

In March the cane, from which two subsequent ratoon crops are taken, is cut by hand with sickles. The women who do the harvesting load it on to lorries to be taken to one of the numerous small sugar factories. The lorries and their loads are weighed and the individual farmers are paid according to weight. The cane is then off-loaded on to the conveyor.

Some factories are State-owned and some privately-owned; they work only for two and a half months and afterwards remain closed for the rest of the year. The sugar is extracted, alcohol for pharmaceutical and spirits is produced, and the residue is compressed for cattle feed.

Spain produces about 400,000 tons of sugar per year, enough to meet domestic needs, but in good years some is exported to Morocco.

A boom sprayer working among the stools of sugar-cane after the crop has been harvested

Weed Control in Sugar Cane in the West Indies

J. R. COX*

This is a comparison of different methods of weed control in sugar-cane, with particular reference to the use of the new triazine weedkillers.

SUGAR-CANE was probably first introduced into the West Indies by Columbus as long ago as 1493. It soon became an important industry, based on small plantations and plentiful labour, and supported the economy of the whole area.

The industry has expanded remarkably during the last 50 years with the advance of plant breeding, new irrigation and cultivation techniques, mechanisation and new methods of weed, pest and disease control. The application of these advances has enabled it to maintain itself in a highly competitive world market.

The very conditions which are ideal for cane growth also favour weed growth. Weeds are one of the planter's chief enemies and if uncontrolled spread quickly over the whole land surface and reduce the yield of both cane and sugar. They also harbour pests and diseases and thus reduce yields even further.

Manual and mechanical methods

Weed control in the West Indies has in the past been carried out by using contract labour to weed set areas for agreed sums of money. This practice of hand weeding was made possible by the large population providing cheap labour. The days of cheap labour, however, have passed with the rapid rise during recent years in the standard of living of the majority of the people. The manual method of weed control is always continuous, since the extensive soil disturbance which occurs leaves a situation ideal for the germination of fresh weed seeds.

This is also a serious drawback with any form of mechanical weed control, and there is no doubt also that constant movement of men or machines over the soil surface does cause detrimental effects to young cane plants.

Chemical weed control

The use of chemicals for weed control is still a young science in all crops, and has only advanced since the spectacular discovery of the hormone weedkillers in the early 1940s. The discovery of 2,4-D, 2,4-dichlorophenoxyacetic acid, opened up a new era for weed control; since its introduction into sugar-cane it has been of great value to the planter and has revolutionised weed control practices. Chemical weed control started slowly in the West Indies because of the initially high costs of the chemicals and the traditional acceptance of the use of labour.

With the decrease in the cost of chemicals and the steady growth in labour costs, chemical weed control soon became cheaper than hand weeding and consequently has replaced it to an increasing extent.

The disadvantages of 2,4-D for weed control are twofold: the poor control of grass weeds and its lack of persistence. Its constant use has also resulted in an increase in the 2,4-D-resistant weeds. These are chiefly grasses, but include also some broad-leaved weeds, such as the sensitive

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plant, *Mimosa pudica*. Other weed-killers, such as PCP, pentachlorophenol, or TCA, trichloracetic acid, have often been added to 2,4-D in an attempt to widen the range of weeds controlled. These chemicals, however, rarely increase the persistency of 2,4-D.

Weed control is required until the cane closes in the rows and can smother all further weed competition. This usually takes 12–16 weeks in plant cane, and 8–12 weeks in ratoon cane, depending on the climatic condition in the different areas. 2,4-D has low persistence because it is quickly washed away from the top layers of the soil, and thus three or four applications are necessary in plant cane and two or three in ratoon cane.

Recent advances

One of the most recent advances in weed control has been the discovery of practically insoluble chemicals which are capable of giving residual weed control for much greater periods than the chemicals previously used. This has introduced a new concept, that of persistent, preventive weed control, promising as spectacular an advance as 2,4-D when it was first used.

Two groups of chemicals exhibit this long residual action, the triazines, which include simazine, 2-chloro-4,6-bis ethylamino-s-triazine, solubility 5 p.p.m., and atrazine, 2-chloro-4-ethylamino-6-isopropylamino-s-triazine, solubility 70 p.p.m., and certain urea derivatives, such as Monuron, N-(p-chlorophenyl)-N′N′-dimethyl urea, solubility 230 p.p.m.

The main characteristics of these chemicals are their very low solubilities and their mode of action, which is principally by root uptake. The extremely low solubilities give these chemicals their characteristic of persistence, since they are only very slightly leached away by irrigation or heavy rainfall, and thus tend to remain in the upper layers of the soil for relatively long periods.

Selective action

The chemicals are exceptionally toxic to weed seedlings. The first rootlets put out by seedlings grow directly into the upper layers of the soil and immediately take up the chemical. The weeds are at their most vulnerable stage, that of just commencing to grow, and the seedlings are killed almost as soon as they have germinated. The chemicals are, therefore, ideal for controlling weed seedlings over a long period of time, virtually preventing weed competition with the cane.

Wherever selective weed control is to be practised there must be a wide margin of safety towards the crop. Fortunately, sugar-cane can tolerate relatively high dosages, 10 lb. simazine (active ingredient) per acre causing no injury to the cane. The chemical is taken up by the roots and broken down in the plant into harmless products; this has been proved by the use of simazine containing radioactive carbon – known as the tracer technique. As a dosage rate of 2 lb. simazine (active ingredient) per acre is sufficient to give persistent control of weed seedlings, there is a wide margin of safety between effective dosage and that which might cause crop damage.

The control of perennial weeds is largely dependent on a lethal dosage accumulating at the root level; for perennial weeds this is often at a surprising depth in the soil and complete control is often not achieved. One weed which has proved resistant is nutgrass, *Cyperus rotundus*.

Method of application

The optimum time of application for persistent herbicides is immediately after planting or reaping, when the ground is weed-free and no further soil disturbance is likely to occur for at least four weeks. On ratoon fields effective application can only be made when the trash is burned or rowed, leaving areas where even application is possible. Even application is essential and the chemicals are best applied from a knapsack sprayer in the normal estate practice.

Aircraft application is also possible and is being developed in several countries. There is a negligible drift problem due to the very slight leaf uptake preventing the accumulation of lethal dosages in the nearby crops. The chemicals are completely non-poisonous to man and thus no special precautions are needed when spraying.

Cultivation practices vary greatly throughout the West Indies and one of the most important factors in the success of this new technique of weed control is fitting it into these differing practices. There must be close examination of the time of application both in relation to the time of planting or reaping and the time of irrigation

The boom sprayer ready for the road at the end of a day's spraying

or periods of heavy rainfall. Detailed investigation of cultivation practices after application is necessary, also of the different weed species and weed potential of each area, and of the long-term economics when compared with present weed control practices.

It is thus necessary for virtually every estate to work out the method which will provide the maximum benefit from the new practice of persistent weed control.

The adaptation to the different estate practices of the new triazines was the object of a recent six-month tour by the writer in the West Indies. An extensive programme of work, involving over 40 field trials, was carried out in Jamaica, Trinidad, British Guiana and Antigua with the help of the technical and field staffs of more than a dozen different estates.

Summary

The transition from hand weeding to chemical weed control has largely been completed in the West Indies. The next advance will be the transition from the use of chemicals requiring two to four applications to relatively insoluble weedkillers generally requiring a single application. The persistent control of weed seedlings enables a weed-free state to be maintained and the prevention of weed competition rather than its cure will lead to the removal of one of the planter's chief enemies.

New Sisal Hybrid

Almost 30 years of research and many thousands of pounds were spent in the programme which resulted in the creation of Sisal Hybrid No. 11648. ' Only an industry with a real appreciation of its production and marketing problems and with faith in the future would have financed such a programme with no guarantee of ultimate success ', said Sir Richard Turnbull, Governor of Tanganyika, speaking at the annual dinner of the Tanganyika Sisal Growers' Association in Tanga on 17 October.

The faster rate of growth and improved leaf production was likely to be the final factor in changing extensive sisal growing on a plantation basis to intensive sisal farming. The Governor stressed the importance of intensive cultivation and the maintenance of soil fertility because ' the Government in the wider field of African agriculture is about to be faced with a similar problem '.

In the past, in order to maintain production, sisal has had to rely on enormous acreages of not particularly good land; with the new hybrid it would be in a position to concentrate itself and to intensify production on the most suitable soils. Besides the mainly agricultural problem of the management of fertility, the difficulties of water management and of human conservatism would have to be faced. A new outlook on the part of the farmer was needed to bring about this 'budding agricultural revolution'.

Mobile Drier for Maize

The Trojan 'Airator' drying maize on a farm near Ibadan in West Nigeria

At Ibadan, in West Nigeria, the Agricultural Extension Services Division – a department of the Ministry of Agriculture and Natural Resources – has been using a Trojan 'Airator' mobile drying unit to dry maize, which hitherto has always been sun-dried.

The problem in Nigeria is that the main crop is harvested in what is called the short dry season, which lasts about 3–4 weeks in late July and early August. In late August the torrential rains begin again and drench the remaining crop. It is then difficult to obtain maize at moisture contents below 20–22%. For safe storage this has to be reduced to about 14%. Consequently, in April, May and June prices rocket to about £20 and £25 a ton, compared to £10-£15 a ton during the dry season.

Trials have been taking place at a local farming co-operative. One of the Nigerian agricultural engineering assistants designed and built a special tray for holding the maize. Like the 'Airator', it was mobile and could be towed anywhere by tractor and it was fitted with an hydraulic ram for tipping. Three bagging-off platforms were fitted to the tailboard, which could be opened completely for delivering into a pit.

The trials have shown that if the 'Airator' is used for a total of only 450 hours each year, and assuming prices of £12 10*s*. a ton for maize in August and £20 a ton in May, a profit of between £2 10s. and £3 per ton can be obtained by artificially drying the crop and storing it in aluminium silos.

During one trial 3¼ tons of wet shelled maize took only 8 hours (including one hour blowing cold air) to reduce the moisture content from 22% to the required 14%. The ambient temperature at the start was 28°C and the ambient relative humidity 80%. Total fuel consumption was 12.4 gal. (9 gal. for the oil-fired heater and 3.4 gal. for the engine to drive the fan).

Photo: FAO

Ceylon. With their teams of oxen yoked as in the days of their forefathers, these farmers puddle their paddy fields after the rains. Their methods have changed little through the centuries

The Machine in Tropical Agriculture

4—Mechanisation of Small Tools and Machines

RAY WIJEWARDENE, B.A.(MECH.SC.), M.A., A.M.I.B.A.E., M.A.S.A.E.

In the three previous instalments the author dealt with the place of the machine in tropical agriculture. Here he deals specifically with the mechanisation of hand tools and cattle-drawn implements and the operations of threshing and milling.

MORE work needs to be done towards designing a suitable harvester buncher for paddy harvesting, similar to those used in Italy and Switzerland, which can be fitted to the basic roto-tilling machine.

The Japanese have also developed a range of machines for threshing, cleaning and milling the crop off small wheat and paddy fields, with the low power consumption of between 2 and 3 h.p., thus operating off the same engine which powers their roto-tiller. The thresher-winnower used particularly little power for its high output – 20 to 30 bushels of grain per hour, as the straw does not go through the concave, only the ears being held against the rotating drum.

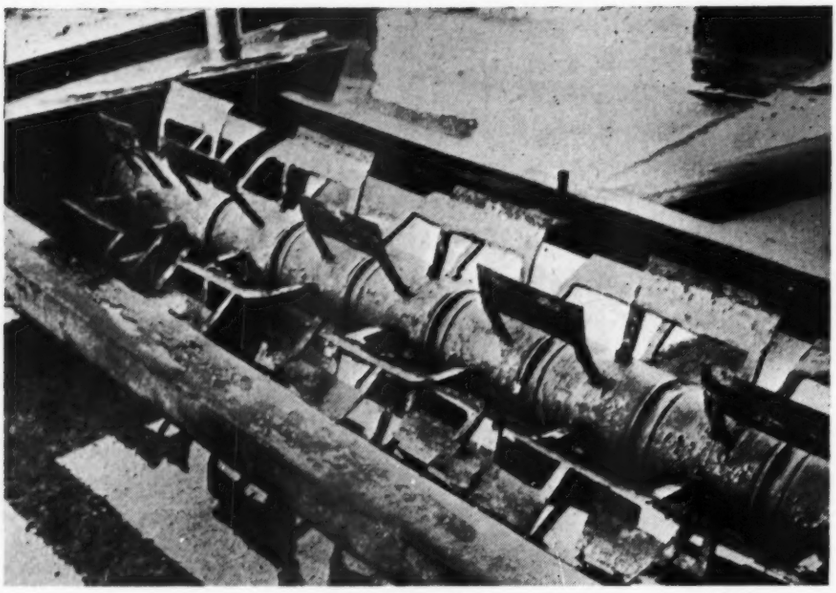
Regrettably, the most neglected of all branches of mechanisation in the tropics are those dealing with improvement of the hand tools and the cattle-drawn implements of agriculture.

Hand tools and implements

Perhaps the amazing versatility of the *mamoty* has been partly to blame for the stagnation. The *mamoty* or mattock is truly an amazing implement and is popular all over the East. In Japan it is called the *tsuda* and in Malaya the *changkol*. Yet the Japanese farmer has not remained stagnant; he has developed various types of mamoty for particular jobs, some with long narrow blades for intercultivation and others with wide blades for turning the soil.

Apart from these modifications of the mamoty, the Japanese farmer uses a wide variety of other hand implements to help both reduce the hours he must spend on his land as well as to improve the quality of his cultivation. One such development, fast becoming popular in Ceylon, is the Japanese paddy field weeder, comprising two small paddle wheels located behind a scow, which maintains flotation over the mud when propelled back and forth in the soil between the rows of paddy plants to eradicate all weeds that might develop there and compete with the paddy.

A fundamental necessity for such weed control is, of course, an implement to sow the seed in rows, and this, too, the Japanese farmer has developed to help eliminate the back-breaking drudgery of transplanting in rows and yet enable him to maintain high yields. The Japanese seed drill is a precision drill, but it is so simple that it can easily be made by the village carpenter. Propelled over the mudded and levelled field, it sows two rows of pre-germinated paddy seed at a time, which drop gently on the surface of the mud. The operation is very economical, as a half-bushel is



Burma. Rotating harrow, a traditional bullock-drawn implement for puddling, and levelling rice field

usually sufficient to seed an acre of land.

Animal-drawn implements

Where operations requiring more power than can be developed by a man are required, such as when ploughing, harrowing, puddling and levelling etc., the approach adopted by the Japanese, Chinese, Indonesian and Malay farmers differs from that of farmers in India and Ceylon. The Far Eastern farmer uses one horse or bull to draw his implement, while his Aryan and Dravidian counterpart uses two.

From the writer's experience the use of one animal is preferable to two, particularly with the constantly increasing demand on land for intensive agricultural production rather than for pasture and fodder. It is also much easier to train one animal to plough a straight row, as it soon learns to plod along the previous furrow or in the lane between two rows of plants. A pair of animals have no such convenient guide and it is little wonder that the local *goviya's** ploughing and cultivation are so erratic.

Another reason for this is the poor harness and means of control used by the local farmer, who relies entirely upon the stick and word of mouth for guiding his team. When using a single animal a pair of reins can be used, thus greatly increasing control.

There is also room for improvement in the design of the plough and harrow, particularly those used in conjunction with paddy cultivation. The placing of a skid before the plough to run in the furrow and thus automatically control its angle, and consequently its depth of cultivation, is one such development which replaces the front wheel of the ' Victory ' or ' Ceres ' plough used on dry land.

Cultivating implements

Nearly all the Japanese farmers use the principle of ' roller ' cultivation when harrowing or puddling their rice fields. This is a very efficient implement requiring very little draught.

The Indian farmer, who is usually a ' dry farmer ', has developed a series of ' blade ' implements which sweep below the surface of the soil and cut off the roots from the stem of weeds, thus destroying them without recourse to excessive ' cultivation ' of the soil. This principle is being tested at Maha Illuppallama, using animals as well as tractors, the object being to leave the ' swept ' trash on top rather than turned in, so as to protect the surface of the soil from the ravages of sun, wind and rain.

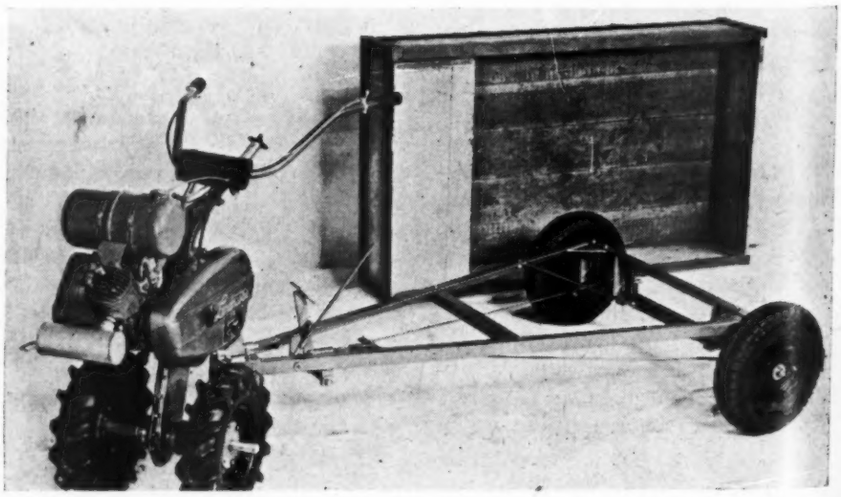
This line of implement is similar to the ' duck foot ' tines and sweeps used in the Western countries on ' dry farms '. The average soils in the dry zone of Ceylon have, however, not proved amenable to this type of implement, which is better suited to the lighter soils found in and around Jaffna, Mannar in the north, and over most of India, and also in the ' dry ' farming districts of Canada and America.

Harvesting operations

The range of implements and tools used for harvesting in Eastern countries is truly amazing. The Japanese farmer still uses a sickle to harvest his paddy and yet uses the very much quicker and more efficient scythe for harvesting his wheat, yet from personal experience the scythe is greatly to be preferred for paddy harvesting, both on account of its ease of operation as well as the output per man-day.

Threshing is another field where the mechanisation of hand- and animal-powered processes can be developed.

(*Continued on page* 441)



The ' Landmaster ' rotary cultivator has many uses. Here it has a chassis attachment which can be used for transporting the paddy

*goviya: peasant cultivator of Ceylon.

Left: *examining a centrifugal in a flour mill for insect infestation.* Right: *an experimental fumigation under gas-proof sheets*

Insects and Stored Food

2—Control Measures Surveyed

E. A. PARKIN,* D.SC., D.I.C., M.I.BIOL.

In the past 20 years tremendous advances have been made as a result of the introduction of methyl bromide, the mixtures of chlorohydrocarbons and phosphine as fumigants, and of DDT, lindane, dieldrin and malathion as the main contact insecticides suitable for control of stored-product insects.

Other promising insecticides await fuller evaluation. Techniques of application have also improved, the most outstanding development in fumigation being the use of gas-proof sheets, and in contact insecticides the introduction of water-dispersible powders and smokes and greatly improved mechanical applicators. In spite of these advances, progress often seems all too slow to the research workers who are aware of the problems which still await investigation or which appear virtually insoluble with the available insecticides and methods for applying them.

Slow progress

There seem to be two main reasons for the slowness of the advance – namely, the relatively small number of workers engaged in this field of research and the complexity of the investigations needed to assess the potential value of any new insecticide. A third difficulty is that of obtaining suitable facilities for full-scale trials of control measures which seem promising on the basis of laboratory investigations.

The first and last of these difficulties can be resolved when greater recognition is given to the importance of stored-product insect control and to the worthwhile return which can come from application of the results of research. The second difficulty – namely, the complexity of the investigations – cannot be overcome in this way, since it is based on immutable features of insect biology, differences in the relative susceptibility of the different insect species to various insecticides, the toxicity of insecticides to mammals etc., the liability of foodstuffs to taint and contamination, and so on.

This means that each insecticide ought to be evaluated against each insect species and sometimes against each developmental stage of the species. Some insecticides available for insect control in agriculture and known to be very toxic to many species of stored-product insects cannot be used in proximity to foodstuffs because of their very high toxicity to man.

Furthermore, certain products are known to be very susceptible to taint and doses low enough to avoid any risk of taint or contamination in a product may consequently be too low to kill the insects concerned. The application of insecticides within buildings is also more hazardous than their application in the open, and this again may preclude the use of some compounds highly lethal to insects.

Resistance to insecticides

Most readers will be aware that, especially in the field of public health, certain species of insects, notably the house-fly, have defended themselves against man's attack with insecticides by developing strains which are scarcely or not at all affected by certain insecticides at the levels of dosage which it is practical, economic and safe to apply.

If a population of insects is exposed to a dose of insecticide which will kill most, but not all of the individuals, there will be a tendency for the progeny of the survivors to have a higher average resistance than the parent population. If selection by the same insecticide is maintained for

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Two aspects of the Pest Infestation Laboratory at Slough. Left: *collecting insects from mature cultures to set up new ones and maintain the stock of insects for research.* Right: *apparatus for automatic scanning of paper chromatograms prepared from insects treated with radioactive insecticides*

many generations the strain will become more resistant to an extent which cannot at present be predicted, but which must be determined by observation and experiment.

In some instances there is very little increase in resistance, the increase probably representing only the selection of a strain of generally more robust individuals, hence referred to as 'vigour tolerant'. In other instances a strain is selected which is so resistant that the insects comprising it are virtually immune from the effects of the insecticide and are certainly so under the limiting conditions of practical dosage.

Fortunately, no intensely resistant strains of stored-product insects have yet been reported in the field, but there have been indications that they may be on the way. The methods of insecticidal application in general use in warehouses are such as to make it quite conceivable that selection of insects for resistance could occur. If a stock of insects has not already been subjected to selection for resistance to any insecticide, selection pressure must be applied usually, but not always, to a considerable number of generations before resistance becomes established at a relatively high level.

Induced resistance

Stored-product insects are usually very much slower in breeding than flies and mosquitoes, so resistance will take correspondingly longer to become established in practice. Nevertheless, since the risk is evident, there is good reason to investigate the possibility of inducing resistance under the artificial but more controllable conditions of laboratory breeding.

Because of the amount of labour and length of time involved, the special difficulties imposed by the slow rate of egg production, and the ever-present risk of losing the stock through exposure to over-dose, this type of research has not been eagerly taken up by stored-product workers. The very few investigations with fumigants and stored-product insects have not so far revealed any degree of induced resistance greater than could be accounted for as vigour tolerance; the one or two instances of potential development of higher levels of resistance have been concerned with the contact insecticides.

Importance of hygiene

The mention of insect control immediately brings thoughts of the application of chemicals, but chemicals should always be considered second to hygiene. Hygiene includes careful preparation for the receipt of goods into store by thorough brushing out of the storage space or, better still, cleaning with a vacuum cleaner; attention must also be given to the removal of accumulations of dust etc. from the tops of beams and from behind skirting fillets.

Goods should be neatly stacked on arrival with free space all round so that each side of the pile can be frequently and easily inspected for signs of infestation and, if necessary, access is available for treatment. An attempt should be made to segregate clean from infested goods, and a plan of turn-over be followed so that the infested goods go out before clean, and older stock before newer. Any re-bagging that may be necessary should be into clean disinfested sacks.

The warehouse floor should be frequently swept and no spillage should be allowed to remain. Sweepings and debris must be removed from the store and burned immediately.

Care must also be taken that partly manufactured foods that may be stored for a few hours or days between processes are suitably protected against infestation and that bagging-off spouts are closed by a slide or cover at the extreme end during stoppages at night or over the weekend.

Not only can the conscientious application of hygienic measures make a considerable contribution to the prevention and control of infestation, or occasionally be sufficient in themselves to avoid attack, but they are also an essential preliminary to the application of other control measures.

Choice of treatment

It is not possible in the compass of this article to attempt any detailed analysis of the factors that govern the choice of chemical control measures. Generalisation is none too easy and the choice of treatment is, as often as not, determined by a particular set of circumstances.

The selection of the most suitable of control measures will depend, among other things, on knowledge of the species of insects concerned and the kind of damage done, the likely

rate of increase of damage, the relative resistance of the insects to the insecticides available, the possible effect of the type of stowage on any contemplated treatment, the formulation of the insecticide and the equipment and labour necessary for its application, the need for repetitive treatment, and the avoidance of effects of the treatment on the product or products in store and on the operators during the application.

There now exists a very considerable, though still incomplete, body of knowledge about each of these factors and the final selection of the appropriate treatment is usually a job for a specialist. Not only is an extensive background knowledge of insects, insecticides and applicators needed, but also considerable practical experience of insect control so that the treatment is made as straightforward as possible by anticipation of and allowance for any practical difficulties.

Whatever the treatment or combination of treatments eventually chosen, there is one golden rule about the actual application – it must be thorough or the labour and cost of the treatment may be largely wasted. Too often failure of a treatment is blamed on anything but the lack of skill and thoroughness of the operators.

Sources of information

With the growth of knowledge it has become clear that generalisations about treatments are scarcely possible, too many situations having unique features. Advice must therefore often be sought, and it may be helpful to record the sources of information available to enquirers in the U.K. They include the following:

The *Pest Infestation Laboratory* is a Government research institute which devotes itself to research mainly on stored produce, and includes investigations of general storage problems, insect infestation and methods for its prevention and control. Active interest is maintained in similar problems in British overseas territories. Enquiries should be addressed to the Pest Infestation Laboratory, London Road, Slough, Bucks.

The Ministry of Agriculture, Fisheries and Food, through its *Infestation Control Division* at Tolworth and regional offices, provides an inspectorate service whose main function is to prevent and control losses of stored produce from insect and rodent infestations. Enquiries should be addressed to the Infestation Control Division, Ministry of Agriculture, Fisheries and Food, Hook Rise, Tolworth, Surrey. In Scotland, help may be sought from the Infestation Control, Department of Agriculture for Scotland, East Craigs, Edinburgh, 12.

The *British Museum* (*Natural History*) is particularly responsible for the correct identification of biological specimens. Enquiries should be sent to the British Museum (Natural History), South Kensington, London, S.W.7.

The *Public Health Officers* of local authorities deal with both insects and rodents, especially in relation to their effects on the quality of foodstuffs.

Help may also be obtained from the technical staffs of certain firms producing insecticidal preparations, or firms offering a pest control service may be consulted. Information on these may be obtained from the *Industrial Pest Control Association*, Cecil Chambers, 86 Strand, London, W.C.2.

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Sampling groundnuts for determination of insect infestation after storage in an experimental sacklet treated with insecticide

The Machine in Tropical Agriculture—4

(*Continued from page* 438)

The Japanese farmer uses a pedal-operated rotating spike drum to beat the ears of rice from the stalks. The Indian farmer has recently developed a sort of chariot on gangs of serrated wheels which a team of animals draws round and round over the paddy to be threshed. The action is similar to the treading of straw by local farmers, who drive about four to eight animals in a circle over the paddy, the difference being that the chariot makes better use of the animals to speed up the threshing.

Conclusion

In all branches of mechanisation of tropical agriculture a very wide field of work lies before the agricultural engineer. A field in which progress so far has only succeeded in touching the fringe of the problem – how to bridge the gap between what the farmer can cultivate himself with his existing tools and what he needs to cultivate to meet the requirements of his home and of his country. Thus the Burmese farmer in a single season can cultivate 10 to 15 acres, as against a meagre one or two acres by the peasant cultivators of Ceylon.

Crop Protection by Seed Treatment

2—Seed Dressings for Sorghum

S. A. J. TARR,* B.SC., PH.D.

Two heads of sorghum - one healthy (right) *and one* (left) *infected with covered smut*

The author here goes on to consider the special requirements of sorghum and once again he recommends a dual-purpose seed dressing, which is likely to pay for itself several times over in the form of considerably increased yields.

SEVERAL million acres of sorghum, *Sorghum vulgare*, are grown annually throughout the Sudan under irrigation in the relatively dry north and under rain in the wetter central and southern regions. Although cultivated mainly for grain, the straw is used as fodder and for a variety of other purposes. Sorghum is by far the most important cereal of the Sudan and more than 100,000 acres of irrigated sorghum and a variable area of rain-grown crops are cultivated each year in the Gezira.

Covered smut and loose smut

For some years sorghum sowing seed has been dusted with either copper carbonate or sulphur powder to destroy spores of covered smut, *Sphacelotheca sorghi*, and loose smut, *S. cruenta*, the former of which can cause very heavy losses of grain. In recent experiments in the Gezira fungicidal seed treatment improved emergence and stands, this beneficial effect being most marked with rain-grown or flat-irrigated sorghum and least with ridge-irrigated sorghum receiving near - optimum moisture conditions.[11] Other experiments confirmed that maximum benefit from fungicidal dressings could be expected where sub-optimum climatic and soil conditions have resulted in slow, uncertain germination and emergence, or where damaged seed was sown.

Cockchafer grubs

Incorporation of 20–40% γ-BHC in the seed dressing improved stands and yields still further. Sometimes there was no evident insect attack, but in other cases the roots of seedlings grown from untreated or fungicide-treated seed were attacked just below soil level by cockchafer grubs of the genus *Schizonycha*, wilting and death quickly following. By contrast seedlings grown from fungicide-insecticide treated seed were rarely affected and showed good even stand and vigorous early growth, although living grubs were present and probably repelled by the insecticide.

Where grub damage occurred, addition of 20% γ-BHC to the seed dressing (0.04%/seed or about 2 g./acre) increased yields of grain and straw by amounts ranging from 20% to 50%, depending on the severity of the attack. Even in the apparent absence of grub damage inclusion of insecticide in the dressing usually resulted in slightly, but appreciably better, stands, perhaps due to protection from root nibbling by soil insects. Sorghum seedlings appeared to be vulnerable to grub attack until surface adventitious roots were established, about three to four weeks after sowing, after which they became much less liable to fatal attack.

Fungicide-insecticide treatment of sorghum sowing seed also improved stands and yields in the central rain-lands region of the Sudan, although the insects involved are not known. Such treatment should also protect stored seed from attack by storage moulds and pests, and discourage ants, which may carry away sorghum seed sown in dry soil.

Dual-purpose seed dressing

From this short outline it is evident that fungicide-insecticide treatment of sorghum sowing seed is likely to pay for itself several times over in the form of considerably increased yields, and in the Sudan efforts are being made to treat all such seed with a powder dressing containing 25% thiram and 20% γ-BHC applied at about 1 : 450 by weight to seed.

Systematic investigation in other countries may well reveal similar advantages to be obtained at little cost by seed treatment with modern fungicides and insecticides. It may be speculated whether witchweed (*Striga* spp.), phanerogamic parasites on roots of sorghum, maize and certain other crops in tropical and sub-tropical regions could be controlled by seed treatment with substances able to destroy witchweed seedlings without harming the host plants. Although such substances are not at present known, the enormous damage caused by witchweed in the Old World tropics (it has also recently appeared in the U.S.A.) makes an investigation into this possibility desirable.

(*To be continued*)

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11. Tarr, S. A. J.: Ann. appl. Biol., 1954, 41, 578-585.

New Publications

Mechanical Cultivation in India

By D. A. Gadkary. Pp. 147. Illus. Indian Council of Agricultural Research, New Delhi. 1957. Price Rs. 7.25 or 11s. 6d.

In 1935 the Imperial Council of Agricultural Research published a monograph on the history of experiments carried out by the Burma-Shell Storage and Distribution Co., of India, in the field of mechanical cultivation. In view of rapid technological advancement in agricultural machinery and implements during the past two decades, the Indian Council of Agricultural Research have published the present volume to record the results of further study of the subject.

Mechanised cultivation is treated in very general terms in this new book. The first of the four chapters, dealing with the scope for mechanical cultivation, is the only one devoted to Indian conditions; succeeding chapters – on farm machinery and implements, selection and maintenance of equipment and organisational aspects – give the reader no idea to what extent mechanisation has developed in India. For instance, chapter 2, on farm machinery and implements, is a general disquisition and contains only two facts about India, *viz.* that ' deep ploughing 10 to 14 inches, is adopted for sugarcane and also for eradication of deep-rooted weeds like *hariali*', and 'The two main types of ploughs used in India are the mouldboard plough and the disk plough '.

One regrets that the large mass of information collected by the author from various States in the country has not been included in this volume, even in a condensed form. The author concludes that ' tools and machines should be designed and chosen to suit operations to be performed under different geographical and soil conditions ', but nowhere is one told of the efforts already made to devise or adapt machinery to the particular needs of Indian agriculture. The reader of this monograph will therefore be unable to obtain a picture of Indian developments in agricultural mechanisation since the publication of 25 years ago.

D. H. GRIST

Technical Books

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as retail booksellers will be pleased to supply any books reviewed in this periodical, and will give immediate attention to any requirements you may have for other works

Farm Management

Methods of Farm Management Investigations for Improving Farm Productivity. By W. Y. Yang. Agricultural Development Paper No. 64. Pp. 228. FAO, Rome. 1958. Price 10s. or $2.

Farm management is here defined as both a pure and an applied science dealing ' with the proper combination and operation of production factors, including land, labour and capital, and the choice of crop and livestock enterprises to bring about a maximum and continuous return to the most elementary operation units of farming '.

This paper is intended as an introduction of methods of farm management investigations to extension workers, agriculture teachers and officials, rural leaders, officers of farmers' organisations and all who are concerned with the improvement of farm efficiency and productivity. These methods are described in detail, with every stage of procedure outlined, so that the techniques may be applied. Both technical and non-technical discussions are included, but advanced statistical methods are used in the investigations and the author stresses that even methods which do not call for such techniques should be carefully treated in order to avoid the risk of misusing valuable data.

The paper includes discussions on the farm business survey, farm bookkeeping and financial accounting, farm business analysis, cost and enterprise studies, marginal analysis of input-output relationship, farm planning, budgeting and programming, farm work efficiency studies, the estimating of machinery cost and the planning of its efficient use, the cost and benefit appraisal of farm and agricultural projects and land tenure problems.

Efficient Use of Fertilisers

Edited by V. Ignatieff and H. J. Page. Pp. 356 with 43 illustrations. Agricultural Studies, No. 43. FAO, Rome. Price 22s. 6d. or $4.50.

A book of this title was first published in 1949; this new edition is a completely revised and enlarged edition which is the outcome of the pooling of knowledge of 96 soil and crop specialists working in 34 countries.

Here, concisely and in simple language, is given up-to-date information on plant nutrients, on the physical and economic factors affecting fertiliser application, and on modern concepts on their most effective use for the maintenance and improvement of soil fertility. The relationships of fertilisers to crop rotation, erosion control, irrigation, drainage, liming and other agricultural practices are lucidly discussed. This is no mere compilation from other books – it is a book produced by two acknowledged experts in the ever-changing field of soil science.

The publishers state that ' this manual has been specially written for the agricultural planner, for the extension worker, for all who, as advisers and teachers working with farmers, are concerned with enlarging the understanding of fertilisers and manures. The farmer himself, and the agricultural student, will also find that this book has much to offer '. We can recommend this useful *vade mecum* to our readers with every confidence.

F. C. COOKE

Ceylon Trees

By T. B. Worthington. Pp. 429 with 429 illustrations and two maps. Colombo Apothecaries' Co. Ltd., Colombo, Ceylon. 1959. Price Rs. 40/- (about 65s., post free).

People living in tropical countries like Ceylon have always wanted to know more about the country in which they live, and particularly about the luxurious vegetation, which is the outstanding characteristic of the wet tropics. They ask the name of a tree, and it is seldom that anyone can supply the answer or tell them anything about the tree or its uses.

This wonderful book gives all the answers. Take the ubiquitous rain tree. Using the index, we learn for the first time that it is not indigenous to Ceylon, but was introduced from Central America in 1850. An excellent photograph helps the total stranger to identify the tree under its botanical name, *Enterolobium Saman*, its common name and its other names in three or four languages. This is followed in each case by details of its habitat, its botanical characters and its timber characteristics.

This book will meet a long-felt want and every forester, planter, big-game hunter, explorer and colonisation officer living in tropical countries should obtain a copy. Even the tourist and townsman can add enormously to the interest of his evening stroll through the botanical gardens in the country in which he happens to find himself.

The author is to be congratulated not only on a thorough and painstaking piece of work, but also on the excellence of the photographs which are to be found on every page of this useful book.

F. C. COOKE

American Tomato Yearbook

Edited by Dr. John W. Carncross. Pp. 40. 8 Elm Street, Westfield, New Jersey, U.S.A. 1959. Price $2.

The 1959 edition contains much interesting and vital information to the tomato grower, the tomato dealer and shipper, the tomato canner, the tomato research specialist and all those with an interest in the tomato industry. Of special significance is the article by Professor Charles H. Nissley, extension specialist at Rutgers University, ' Factors Important in Successful Tomato Production '. There is also a complete and up-to-date list of recent references to tomato culture, tomato diseases, pests and their control.

American Potato Yearbook

Pp. 80. 8 Elm Street, Westfield, New Jersey, U.S.A. 1959. Price $2.

A special feature of the 1959 edition is the illustrated article on the National Potato Breeding Programme by Dr. R. V. Akeley, U.S. Department of Agriculture, Beltsville, Maryland. Also included are complete figures on potato acreage, yield, production, farm disposition and utilisation in the U.S. from 1919 to 1957. There is, in addition, a current list of recent references to potato culture in the U.S. and Canada, comprehensive information on U.S. standards for potatoes and complete details on leading potato producing areas.

Other interesting items include rules and regulations affecting the shipment of seed potatoes, 1959 acreage guides, a list of leading U.S. and Canadian associations engaged in the improvement of potatoes, together with the names of seed certification officials. The revised 1959 Onion Supplement includes recently published articles on onions, leading onion-producing areas and other useful statistical information.

Bulletins and Reports

Forestry Commission, Thirty-Ninth Annual Report for the year ended 30th September, 1958. Obtainable from H.M.S.O., Kingsway, London, W.C.2. Price 5*s*.

West African Cocoa Research Institute. Technical Bulletin No. 7, ' The Virus of Cacao ' by J. M. Thresh and T. W. Tinsley. Obtainable from the Crown Agents for Oversea Governments and Administrations, 4 Millbank, London, S.W.1. Price not stated.

Organisation for European Economic Co-operation. ' Fertilisers – Production, Consumption and Trade in Europe ', 8th Study, 1956–59, price 7*s*.; 'Agricultural and Food Statistics', February 1959, Statistical Bulletins Series, price 12*s*.; ' List of Agricultural Press and Periodicals in OEEC Member Countries ', 1959, Documentation Series, No. 11, price 7*s*. All obtainable from OEEC, 2. Rue André-Pascal, Paris 16e.

International Institute for Land Reclamation and Improvement. ' Land Consolidation in Europe ', Publication No. 3/E, prepared by Erich H. Jacoby and based on the work of the Working Party on Consolidation of Holdings organised under the Sub-Commission on Land and Water Use of the European Commission on Agriculture, FAO; ' Soil Survey and Land Classification as Applied to Reclamation of Sea Bottom Lands in the Netherlands', Publication No. 4, by Ir. H. Smits and Dr. A. J. Wiggers; ' Water Deficiencies in European Agriculture – A Climatological Survey ', Publication No. 5, by J. C. J. Mohrmann and J. Kessler; ' Some Aspects of Sprinkler Irrigation in Tropical Regions', by J. C. J. Mohrmann, Bulletin No. 2. All obtainable from the Institute, Postbus 45, Wageningen, Holland. Prices not stated.

Department of Agriculture, Fiji. ' The Weeds of Fiji ' by J. W. Parham. Bulletin No. 35. Obtainable from the Department of Agriculture, Suva, Fiji. Price 5*s*.

Ministry of Agriculture and Lands, Jamaica. ' Brown Stem of Oranges Investigation ' by R. A. deFossard, B.SC.(HONS.). Bulletin No. 56 (new series). Obtainable from the Ministry of Agriculture and Lands, Jamaica, West Indies. Price not stated.

Commonwealth Scientific and Industrial Research Organisation, Australia. ' Katherine Research Station – Progress Report, 1946–56 '. Obtainable from the Division of Land Research and Regional Survey, C.S.I.R.O., Melbourne, Australia. Price not stated.

Pea Growing Research Organisation Ltd. Annual Report for 1958. Obtainable from the Secretary, Pea Research Station, Yaxley, Peterborough. Price 1*s*. 6*d*.

Empire Cotton Growing Corporation. Progress Reports from Experiment Stations, Season 1957–58: ' Tanganyika Territory, Lake Province'; 'Tanganyika Territory, Eastern Province '; ' Kenya '; ' Survey of Reports '. Obtainable from the Empire Cotton Growing Corporation, 12 Chantrey House, Eccleston Street, London, S.W.1. Price 1*s*. each.

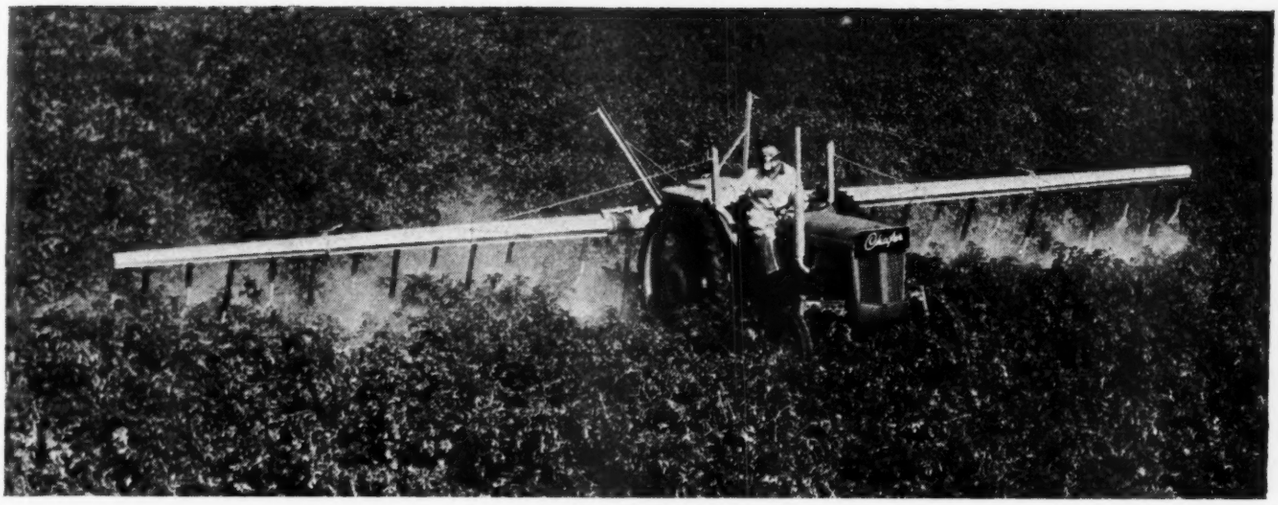
Technical News

Articles in the December issues of some of the other journals of the Leonard Hill Technical Group include the following:

Manufacturing Chemist. – ' Chemical Pumps ' by W. F. Riester, DR.ING., M.I.MECH.E.; ' Vitamin Products ' by G. R. Wilkinson.

Corrosion Technology. – ' Corrosion of Stainless Steels and Related Alloys in Marine Environments ' by J. C. Rowlands.

Specimen copies of the above journals are available on application to Leonard Hill House, Eden Street, London, N.W.1.



16-row dusting by the ' Dustmaster '

Agricultural Machinery and Chemicals at Smithfield Show

THE finest pedigree meat- and milk-producing cattle, sheep and pigs, and in the carcass section some 422 special beef, mutton, pork and bacon entries were on display at this year's Smithfield Show (which once again was held at Earls Court), together with the latest chemical and mechanical aids to good farming.

The equipment shown ranged from monster combine harvesters to delicately engineered spraying equipment; from giant crawler tractors to small farm tools and implements; from the latest forage harvesting machines to the delicate instruments for recording moisture and temperature conditions.

The chemicals ranged from the most recently introduced artificial fertilisers to manures, derived from seaweed, composted vegetation and organic wastes; and, of course, there was the full repertoire of nematocides, fumigants, fungicides, acaricides, aphicides, insecticides, herbicides and repellants, and the patent foods, the antibiotics and the veterinary products used by the modern farmer.

In the following pages some details, necessarily brief, are given of some of the latest introductions and inventions in the field of agricultural engineering and agricultural chemicals. There will be a further account in our January issue.

Britain is now firmly established not only as the country with the world's most highly mechanised farming system, but also as the world's largest exporter of farm tractors and machinery. Smithfield Show, too, has come to be recognised as the finest agricultural exhibition in the world.

A

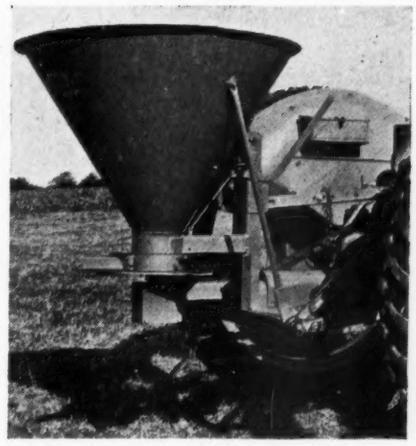
In their 1960 range of spraying machines, *E. Allman & Co. Ltd.* are using the ' Rollervane ' pump exclusively. Their new ' Speedispray 60 ' is a low-volume, 18-ft. boom sprayer, but it is also capable of an application rate of 40 g.p.h. at 4 m.p.h. The 'Sussex' fertiliser spreader – another new introduction – is a spinner-type, tractor-mounted machine which is fitted with a p.t.-o. guard. They were also showing their implement-washing machines.

B

The ' Sapper ' reardozer, another introduction, represents a new approach to the problems of control and wheel adhesion in earth-moving. This new earth-moving blade, which has been designed for use with *Massey-Ferguson* tractors, was shown fitted to an M.-F. ' 65 ' tractor. Other exhibits on the stand of *Bomford & Evershed Ltd.* were the ' Sapper ' powerdozer, the reargrader and the ditcher of the ' Sapper ' series of earth-moving machinery.

Handy farm trucks

A small motorised, 3-wheeled truck, powered by a *Villiers* 5/6-h.p. petrol engine, was shown by *Bonser & Co. Ltd.* The load is carried directly over the rear wheels and tipping is effected by means of a lever situated behind the



Allman ' Sussex ' fertiliser spreader as mounted on the 3-point linkage

driver's seat. This handy means of transport should be of special interest to planters, farmers and market gardeners in many countries. They were also showing tractor-mounted and tractor-drawn versions of the 'Agrotiller' rotary cultivator. The 50-in. and 60-in. mounted models are now offset to the left, to allow cultivating to be done round obstructions.

The 'Cornox' range of weedkillers was the main feature on the stand of *Boots Pure Drug Co. Ltd.* 'Cornox K,' a new introduction, contains 30% of the potassium salt of MCPA and can be used on spring oats at the half-leaf stage.

Bonser 'Agrotiller' rotary cultivator seen in action

Stay dry

Bristol Metal Components Ltd. were showing two new additions to the 'Sta-Dri' range of tractor cabs. A new cab for the *Nuffield* '3' and another for the *International* B275 high-clearance tractor. The outstanding features of these cabs are the lift-on-and-off fibreglass roofs, the easily removable doors, and sliding side windows and full-vision backcloth.

A sleek new version of the Bristol '25' crawler tractor was presented by *Bristol Tractors Ltd.* It has the same Perkins P3 engine and the same transmission, but the final drive has been redesigned and the bonnet and radiator has been given clean functional lines and is made of heavy-gauge steel to meet the arduous conditions of earth-moving and forestry operations. The new tractor – to be known as the 'Series D' model – is now available in four basic track gauges – with 30-in., 33-in., 44-in. and 52-in. track centres.

Reader Service

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C

Big boom duster

The 'Dustmaster' is a boom duster with a 36-ft. boom, fitted with 16 inter-row, fish-tail downpipes through which the dust is blown into the foliage of the crop under treatment. This remarkable machine was to be seen on the stand of *J. W. Chafer Ltd.*, together with a prototype dusting machine for hops. The boom duster can be detached from the tractor and left standing on its own legs and the booms can be folded back.

Cooper, Pegler & Co. Ltd. were exhibiting their complete range of spraying and dusting machinery, including knapsack models, small and large power machines. They also had a display of their lances and nozzles. Their 15-ft. telescopic lance, fitted with a cone, fan or variable spray jet, will lift a chemical spray to a height of up to 25 ft. from the ground and appeared to be very suitable for spraying deciduous fruit trees and young trees, such as mangoes, coconuts and rubber in the tropics.

The radial movement of the Hayter 'Spring-matic' orchard wing permits cutting right up against and around tree bases without damaging them

D

The *Dorman Sprayer Co. Ltd.* have further increased their range of crop sprayers by the addition of machines for the small farmer. They also showed a mounted hop sprayer, which can be converted for tree spraying. In all they were exhibiting about 23 different sprayers, ranging from small knapsack sprayers to the large 'Super' 200-gal. trailer machine.

E

Lightweight diesel engines were the principal feature of the stand of *Enfield Industrial Engines Ltd.* The range shown meets the power output requirements from 2 b.h.p. to 22 b.h.p. Their single-cylinder, model '350',

high-speed, air-cooled diesel engine has a wide variety of agricultural applications on account of its lightness and sturdiness.

F

Farmfitters Ltd. showed a range of horticultural machinery, including the 'Versatiller' garden cultivator, the 'Rapier' mower and the 'Bushwakka' scrub cutter. Their 'Sexton' grass cutter – a small compact model – while primarily designed for ease of manipulation among grave stones, would appear to have special uses in botanical gardens and among experimental plots.

Space travel

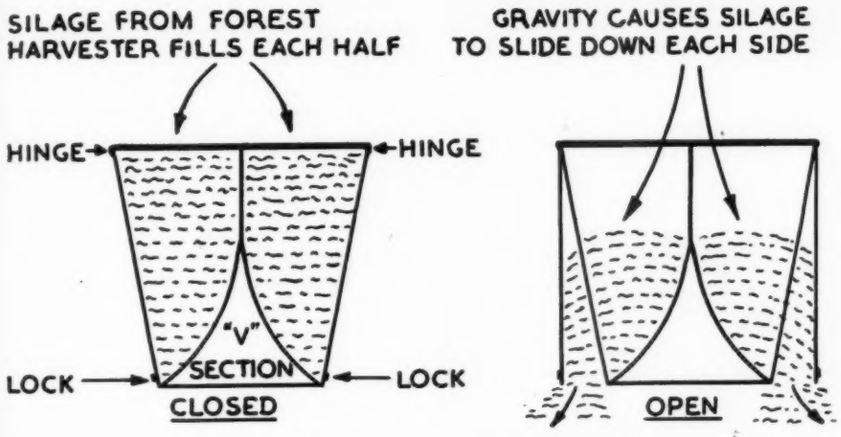
A 'Dexta' fitted with a reversible plough and rotating in its turning circle of 17 ft. inside a 'Flying Saucer', was to be seen on the stand of the *Ford Motor Co. Ltd.* This attracted considerable attention to the powerful 'Major' tractors, the special golf course tractor and the narrow vineyard tractors arranged below. The new narrow Dexta is only 52 in. wide and has a 6-speed gearbox. It is designed for a host of special jobs in vineyards, orchards, hop-fields and soft-fruit plantations.

H

Of particular interest to growers of orchard crops, including coconuts, coffee and cocoa, the new 'Springmatic' orchard wing can be fitted as a nearside or offside extension to the *Hayter* '6/14', 6-ft. trailing grass cutter, which is p.t.-o. operated. This 2-ft. 3-in. side extension can be moved radially, so making it possible to cut close to and around the base of each tree. This operation is accomplished by means of a compensating spring mechanism, provided with easy adjustment to vary the movement and timing.

J

The latest *Jones* Mk. IV baler is easy to handle in the tightest corner, for the overall width of the standard model is only 7 ft. 11 in., and, if required, it can be made only 7 ft. 2 in. wide at no extra cost. The grooved bales it produces make it virtually impossible for the twine to slip off; they are 14 in. × 18 in. in cross-section and the length is adjustable from 20 in. to 36 in. Bales of up to 80 lb. in weight can be obtained and the maximum speed of production is six per minute.



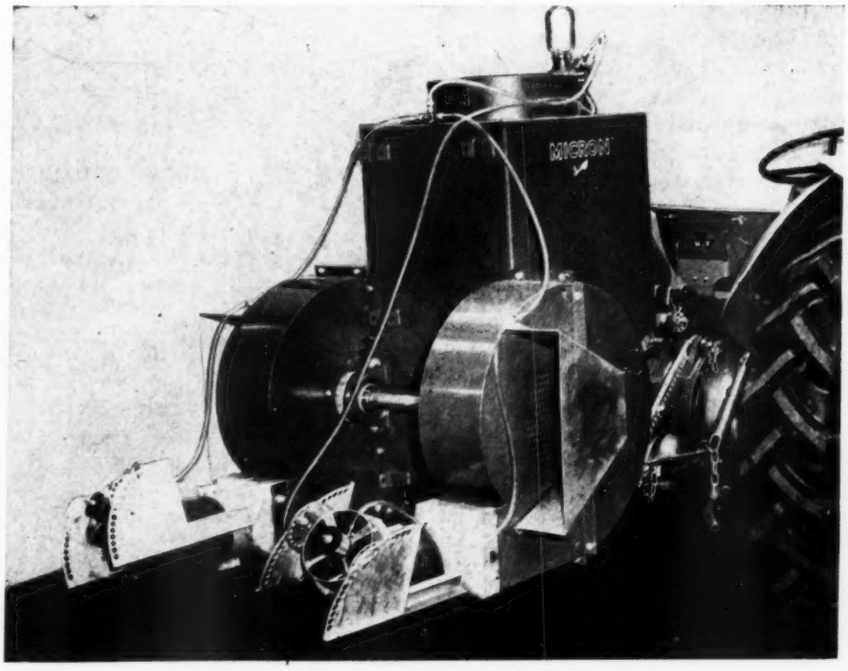
Quick-release silage transporter by Keenan Brothers

K

A quick-delivery silage transporter was introduced by *Keenan Bros. Ltd.*, which is designed to sit on any non-tipping trailer. It consists essentially of two V-shaped containers for the silage, which is released when the two hinged sides are opened. When they are locked again the transporter is ready for filling.

M

There was a complete range of agricultural weedkillers on the stand of *May & Baker Ltd.*, including 'Planotox' – a rain-resisting brand of 2:4-D and 'Embutox' – a 2:4-DB formulation for undersown cereals and seedling lucerne. There was also 'Tropotox Plus', an MCPB/MCPA mixture to deal with heavy infestations of cruciferous weeds. 'Compitox' CMPP can deal with chickweed and cleavers, as well as other common weeds, while 'Spontox', a formulation containing 2:4-D and 2:4:5-T, is a brushwood killer, suitable for weeding forest trees and clearing tsetse belts. For potato blight they had 'Tubosan', a ziram/copper sulphate fungicide.



The tractor-mounted Micron concentrate sprayer

Ransomes' new TG3007 rotary slasher

For vineyards and hop fields

The following machines were shown by *Micron Sprayers Ltd.:* The Micron 'Twin', a tractor-mounted concentrate sprayer fitted with a rotary atomiser and designed for spraying fruit trees, hops, coffee, cocoa etc., and with a special attachment to make it suitable for ground crops; the 'Micronette', a trolley- or shoulder-mounted model; a lightweight machine mounted on a wheeled trolley for spraying outdoor tomatoes, bush fruits and vineyards; and a new concentrate sprayer for fitting to vineyard tractors for use in vineyards and in hops and cordon fruit trees.

N

The latest introduction by *Nu-Way Heating Plants Ltd.* seen at the Show was the 'Econoil X19' air heater, which will produce warm, dry air for drying hay in barns, for heating glasshouses in winter and for warming the air in farm buildings and dairies – with a consumption of only 2 gal. of diesel or gas oil per hour and a power requirement of 76 kW.

P

The engineers of *Plant Protection Ltd.* have designed a new seed-treating machine for applying either liquid or powdered cereal seed dressings. It is operated by electricity and has a maximum capacity of 280 bushels per hour; if required, both types of dressing can be applied simultaneously. Thus the seed can be treated with 'Agrosol' – a fungicidal liquid seed dressing – and then dusted with an insecticidal dust, without any risk of over-dressing, according to the exhibitors of this machine.

R

Of special interest to overseas visitors on the stand of *Ransomes, Sims & Jefferies Ltd.* was the new TG3007 rotary slasher. This rugged and powerful implement will cut a 66-in. swath through really tough undergrowth and, we were informed, the cut vegetation is reduced to a mulch. The height of cut can be adjusted from 2 in. to 16 in. Another new introduction was the 'Tillorator', a mounted spring-tine harrow. The tines are staggered at 4-in. intervals and their vibratory action breaks up the clods and produces a fine tilth.

Amongst the exhibits of *Russell's (Kirbymoorside) Ltd.* there was a new 4-row seed drill, adjustable from 14 in. to 26 in., and so suitable for a wide variety of crops. It is a sturdy, rear-mounted, p.t.-o.-operated implement, equally as suitable for the small grower as for the larger farms. They were also showing their precision spacing seed drills and fertiliser placement drills, the 'Kwikset' steerage hoe and a down-the-row thinner.

Wolf ¼-in. capacity double-insulated general-duty drill repairing an agricultural machine

S

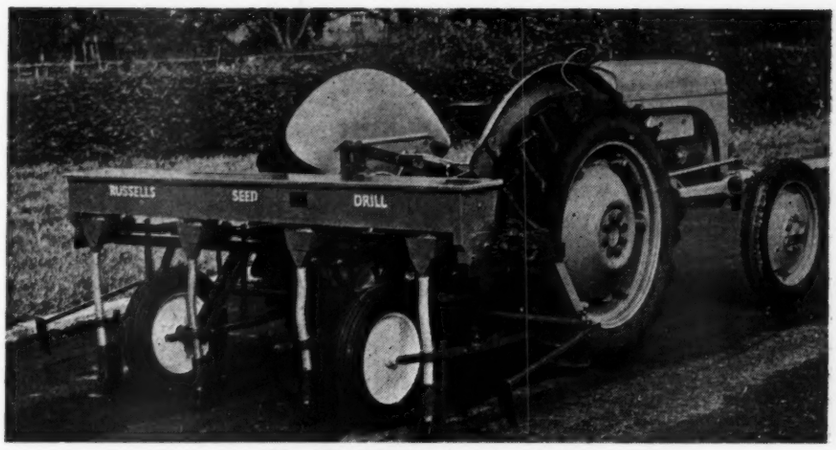
Neptune's bounty

Seaweed Agricultural Ltd. were exhibiting various samples of their blended seaweed meals for animal feeding and for use as manure and 'Maxicrop' liquid seaweed for use as a liquid feed and as a soil conditioner or foliar nutrient. These products contain trace elements, hormones and soil conditioners derived from marine plants.

'Plantector' seed dresser complete with liquid and powder attachments

The *Shell Chemical Co.* were demonstrating two new liquid seed dressings – ' Panogen ' and ' Astex ' – and a working model of their Model 'A' seed treater, which has been specially designed for the application of these two new formulations. There were also samples of treated and untreated seed, the results of germination trials, and a comparison of their resistance to fungicidal attack. Their new nitrogenous fertiliser, ' Nitra-Shell ', was prominently displayed in association with a panel dealing with grasses and grassland management.

In addition to showing the ' Dandy ' and the Mk. IV (export) forage harvesters, *Silorators Ltd.* were demonstrating four uses for their new 'Auto-Drop ' forage wagon chassis, *viz.* as a wagon for the high-speed unloading of green crops, as a low-loading trailer, as a mobile silage self-feeder and as a mobile zero grazer – by fitting various additions to the standard chassis.



Russell's SWM3 four-row drill

T

To meet all the needs of the provender industry, *Templewood Hawksley Ltd.* have introduced the ' Novapress ', a machine designed for the cold cubing of pellets and cubes, and of a size to suit the needs of medium and larger mills. The 'Junior' provender press will still provide for the smaller mills. Both models were shown together with the Templewood grain drier, a sturdy cage-wheel attachment for tractors and the ' Multi-Culta ' down-the-row thinner.

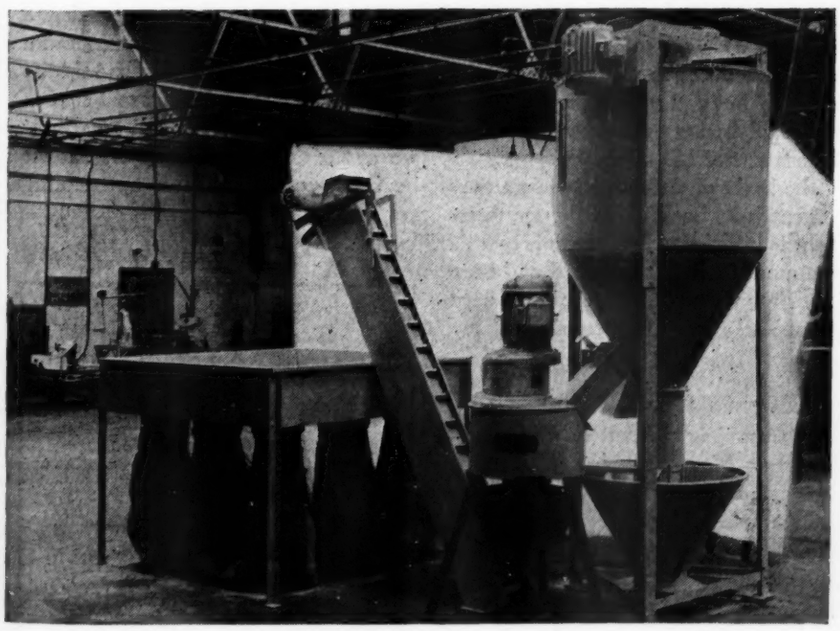
The *Templewood-Colman* system of barn hay drying is based on the many years of development work carried out by the E.R.D.A. and now provides every farmer with a complete hay drying process.

W

Wolf Electric Tools can be rightly described as the ' Farmer's Friend ', as the portable tools they showed will enable him to do small running repairs to his agricultural machinery and equipment and so avoid lost time during rush periods. This is particularly the case with farms and plantations in remote areas, where no facilities whatever exist for such work, and as a result valuable machines are left to become derelict merely because of some minor breakage.

Model 'A' seed treater supplied by Shell Chemical Co. for use with ' Panogen ' and 'Astex' liquid seed dressings

Surrounded by nine new introductions, the ' Merry Tiller ' Major – the small machine with the large performance – formed the centre-piece on the stand of *Wolseley Engineering Ltd.* There was a new heavy-duty version – the ' Professional ' – which is fitted with a powerful 4-stroke engine, and yet is quite manoeuvrable even when digging to a depth of 12 in. at a width of 33 in. with three sets of rotary slashers. There was also a new 16-in. roller mower, a 5-cwt. truck attachment, a mechanical sweep for clearing up hay or prunings, a wider rotor to produce a 44-in. seedbed and various accessories for electric fencing.



A small provender milling unit, incorporating the ' Junior ' provender press

Agricultural Chemicals

Warble-free Hides

It is said that the warble fly costs Britain some £3 million per year and that warbles are to be found in at least one-third of the cattle population. The damage to the cattle of the world from this cause may well represent a loss of over £100 million a year. These losses include loss of milk yield and of body weight; injuries to the animals during stampedes caused by warble fly attacks; maggot-perforated flesh which has to be cut away; and very extensive damage to the hides, which may either be holed or covered in warbles. Hides so damaged cannot, of course, be accepted as fine leather and the damaged portions are wasted.

Warble flies make darting attacks on the animals, each time laying one or more of their eggs among the hairs of the legs or belly. Mass attacks can so severely disturb the animals as to cause them to gad about wildly and even stampede. These eggs hatch out in a few days; the tiny maggots which emerge burrow into the skin, perforate it and travel very slowly through the body of the animal, feeding and growing during the next six months until they reach its back, where they lie in cavities just below the skin, so forming the characteristic swellings known as warbles. The grubs by this time have become large and fat; each one makes a small breathing hole in the skin and four weeks later, when fully developed, it bursts through and falls to the ground. Here it pupates and the adult fly emerges. The young flies mate, lay their numerous eggs and so the story is repeated again and again many times over.

The fly usually remains near the cattle, which it finds when it emerges, as it does not fly very far. This means that if a herd can be cleaned up properly it is not likely to be re-infested. Hitherto the method of control has been by the application of a contact insecticide, rotenone, usually in the form of a derris wash, well scrubbed into the backs of the animals.

This treatment, although effective, can only kill the maggots after they emerge and after they have done the damage. Secondly, since grubs keep on breaking through the skin over a period

What warble fly grubs can do to a hide

of about five months, as many as five treatments at monthly intervals are necessary for effective control by this method. If this is neglected, as it well may be, the pest can go on taking its toll year after year.

The systemic insecticide, ' Co-ral ', offered by *Cooper, McDougall & Robertson Ltd.*, will kill the warble fly maggots while they are passing through the body of the animal, while they are still small, and before they have done much damage, *i.e.* before they have had a chance to damage the hide. This insecticide is absorbed into the animal's body through the skin and, if applied during the winter, will effect almost a total kill of the tiny maggots in the body of the animal before they can reach its back. Usually one treatment is sufficient. It is possible by this treatment to clean up a herd and keep it so, as a clean, self-contained herd is not likely to be reinfested.

Liquid Seed Dressing

' Ceresol ' is claimed by the manufacturers, *Plant Protection Ltd.*, to be the first dual-purpose liquid dressing ever to be marketed.

It is applied to cereal seed for the control of wireworm and also of the following diseases: bunt of wheat, covered and loose smut and leaf stripe of oats, barley and rye. It is also claimed to give much better control of foot rots and seedling blights than dry seed dressings.

'Ceresol' prevents wireworm attacks on cereals when the population in the soil does not exceed 600,000 per acre.

The special advantages of liquid over powders are absence of dust, the glossy and attractive appearance of the seed after treatment, greater control of *Fusarium* and *Septoria* than is obtained with powders and reduced phytotoxicity, since a smaller percentage of mercury is required.

Fertiliser Starter

According to an Agricultural Bulletin recently issued by the *Olin Mathieson Chemical Corporation*, starter applications of soluble phosphate will stimulate the wheat crop to rapid early growth, as the plants are able to use more effectively the nitrogen and other nutrients in the soil. This ' starter effect ' is attributed to an initial build-up of an active phosphate reserve inside the young wheat plants.

'Ammo-Phos ' is the most soluble of all phosphate fertilisers and its starter action is enhanced by having ammonium nitrogen combined with the phosphate. The combination permits a more rapid rate of entry of fertiliser nutrients into the plant tissues.

Where extra nitrogen is needed a topdressing of urea or ammonium nitrate is applied. This should be spread when the plants are between 7 and 12 cm. in height and on winter wheat the urea nitrogen applied at the beginning of spring gives outstanding response.

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WORLD CROPS,
Leonard Hill House,
Eden Street, London, N.W.1,
England

World Crop Reports

Coffee, Sunflower Seed Up; Pepper Production Down

INTERNATIONAL REPORTS

Coffee

The total 1959–60 world coffee crop is forecast at 67.4 million bags. The revised 1958–59 total crop has been estimated at 60 million bags.

North American coffee production for 1959–60 is estimated at 9.5 million bags. This season's exportable crop in Costa Rica is expected to be slightly higher than the relatively low 1958–59 crop.

The Dominican Republic and Haiti are expected to have considerably larger crops in 1959–60, as this is the 'on year' in the production cycle. Crop conditions continue to be favourable in El Salvador and Guatemala. Total production for 1959–60 in each of these countries is estimated at 1.5 million bags. Production in Honduras and Nicaragua continues to increase. Mexico's total 1959–60 crop is estimated at 2.1 million bags, which would make Mexico the world's fourth largest producing country.

South America's total 1959–60 coffee production is estimated at 44.9 million bags. Total 1958–59 production in South America was 39.5 million bags.

Brazil expects this season's crop to reach 35 million bags, with an exportable crop of 30 million. A record exportable crop of this size would be 15% above 1958–59, about 45% above 1957–58. Colombia also expects its crop to reach a record level. It is now estimated at 8 million bags; this would be .3 million bags above the revised estimates for 1958–59. Rainfall has been generally adequate this year in the important producing areas, whereas last year dry weather reduced the harvest in some areas.

Production in Ecuador for 1959–60 is estimated at .55 million bags. Venezuela's crop is estimated at 850,000 bags, the same as for 1958–59. Coffee production is increasing in Peru and is expected to total .4 million bags in 1959–60.

Africa's crop in 1959–60 is estimated at 10.6 million bags. Record crops are expected for most of the African countries, to give about 5% above 1958–59 out-turn. Favourable weather

Photo: Leonard Hill Books

Pepper growing in the British Cameroons

in French West Africa and British East Africa are expected to bring bumper crops in those areas, and the crop in Tanganyika is reported to be maturing well. The bad weather in March 1959 in the Malgache Republic is now expected to reduce the 1959–60 crop considerably, but damage to the 1958–59 crop was not as serious as was believed earlier. Ethiopia's 1959–60 crop is expected to exceed the rather low 1958–59 crop.

Asia and *Oceania* are expected to produce a total of 2.44 million bags. Indonesia and Yemen should equal their 1958–59 production, while India will probably have a slight increase.

Pepper in 1958

The most recent estimate of 1958 world pepper production is 147 million lb., 14% below the 1957 crop of 170.9 million lb.

Indonesian production declined 14.9 million lb. from the 1957 level. This decrease was in white pepper; black pepper production rose slightly. *Sarawak's* 1958 crop of 21.8 million lb. was 9.5 million lb. below the 1957 level and 22.6 million lb. smaller than the record 44.4 million lb. in 1956. Disease, low prices and abandonment of pepper by those growers not dependent upon it for a livelihood were the main reasons for the decline.

India is estimated to have produced 60 million lb. during 1958, compared with 61.2 million lb. in 1957 and 61.6 in 1956.

Pepper in 1959

World pepper production in 1959 is forecast at 149 million lb., slightly higher than the 147 million lb. of 1958, but somewhat below 1956 and 1957 and the pre-war (1935–39) average.

In Indonesia production is expected to increase and is forecast at 42 million lb. Plantings made during 1949 and 1950 should insure production at least at this level. In Sarawak a further decline is expected, with 1959 production forecast at 19 million lb. India's output during 1959 is forecast at 60 million lb., which is unchanged from 1958; no increase in production is expected.

Ceylon still uses most of the pepper it grows. *Tahiti* may begin exporting small quantities in the next few years. *Brazilian* production continues to increase and a total of 10 million lb. is expected within the next few years.

Sunflower Seed

World sunflower seed production in 1958 is estimated at 7.1 million short tons, up more than 40% from 1957 and more than double the 1935–39 average. A sharp increase in the *U.S.S.R.* and larger crops in *South America* accounted for most of the increase last year.

Production in 1959 may be somewhat below the 1958 record because of severe losses in Argentina and *Uruguay* from disease and floods earlier this year. However, these losses may be partly offset by increases in the U.S.S.R., *Canada*, and the *Union of South Africa*. The record 1958 out-turn in Canada, the only North American country reporting any sunflower seed production, was almost double the 1957 crop.

Sunflower seed is the major oilseed grown for edible oil in three *South American* countries – Argentina, Chile and Uruguay. The 1958 crop in these countries exceeded 1 million tons and was one-fourth above the 1957 crop. In 1959, however, disease and floods have reduced Argentina's crop by almost one-half from 1958 and the crop in Uruguay is probably less than one-half of last year's. Chile had some rain damage prior to harvesting.

The 1958 crop in Europe was slightly above 1957, due mainly to larger acreage. But last year's crop was 30% below the 1953 record of almost 1.1 million tons.

Sunflower seed provides about three-fifths of the U.S.S.R.'s annual edible oil output, and production has expanded rapidly since 1950. The record 1958 crop was 62% larger than the drought-reduced 1957 out-turn and 15% above the previous record set in 1956. There has been some increase in acreage, but most of the rise is due to higher yields. As almost all sunflower acreage is unirrigated, weather is important, as evidenced by the drought-reduced 1957 crop. Acreage increased slightly this year and if weather is favourable there could be another record crop.

Africa as a whole grows about 100,000 tons of sunflower seed annually, most of it in the Union of South Africa. The Union's 1958 crop was slightly below the record 1957 crop, but a new record was set by the recently completed 1959 harvest of 100,000 tons.

Asia's production – mainly in Turkey – has varied little in recent years. China's output, estimated on the basis of Western European imports, has increased somewhat since 1954.

REGIONAL REPORTS

China

According to a special communique issued by the Chinese Government, *grain* production for 1958, originally estimated to be 375 million tons, is now stated to be 250 million tons, or one-third less. *Cotton* output is now put at 2.1 million tons, about 37% less than the original estimate of 3.3 million tons.

It is also announced that the targets for 1959 have been lowered – for grain, from 525 million tons to 275 million tons; and for cotton, from 5.2 million to 2.3 million tons.

Egypt

The *cotton* acreage for 1959–60 is expected to be 8% below 1958–59 plantings. The first official acreage estimate placed it at 1,827,000 acres, against the final acreage of 1,977,000 last season. The 1958–59 cotton crop was 10% above 1957–58, and was the largest since 1937–38.

Cool weather has delayed planting of the 1959–60 crop by 10–15 days, but it is making good progress with no unusual disease or insect problems.

Cyprus

Citrus production during the 1958–59 season is estimated to have been about 60,000 tons. According to the report of the Director of Commerce and Industry of Cyprus, although this was slightly below the previous season's record production of 64,363 tons, it was well above the 1956–57 production, which was about 46,000 tons. Both the grapefruit and Valencia orange crops were above those of last season.

Burma

A larger *cotton* crop is expected in 1959–60. In contrast to the past three seasons, moisture conditions were favourable this year during both the planting and growing seasons.

The current crop is roughly estimated at over 90,000 bales (500 lb. gross). The 1958–59 crop was 65,000 bales, and production averaged 77,000 bales in the five years 1954–58. Some improvement in the quality is also expected this season, as more improved short-staple seed was distributed for planting.

England and Wales

The weather during September was warm and sunny and exceptionally dry, except for some rain which fell in most areas on the 21st. Between the 22nd and 27th rain fell occasionally in many districts, chiefly in the north of the country, but parts of eastern and southern areas were fine and dry.

The harvesting of all cereal and pulse crops was virtually complete. Quality and condition of *wheat* were generally very satisfactory; yield per acre was forecast at 28.6 cwt., as compared with a five-year average of 24.8 cwt. and a yield of 24.5 cwt. in 1958. *Barley* condition and quality were generally good, although some areas reported variable quality due to the dry weather conditions. The yield was expected to be 25.6 cwt. per acre, as compared with a five-year average of 23.1 cwt. and a yield of 22.8 cwt. in 1958. Condition of *oats* was good, but in some areas the quality was variable. The yield per acre was forecast at 22.1 cwt., as compared with a five-year average of 19.9 cwt. and a yield of 19.8 cwt. in 1958.

The estimates of yields per acre for *other crops* made on 1 October were as follows:

	1959 *yield* *cwt.*	1958 *yield* *cwt.*	*Average* (1954–58) *cwt.*
Mixed corn ..	21.8	19.6	19.8
Rye for threshing	19.3	19.4	19.4
Beans for stock-feeding ..	16.1	16.1	17.2
Peas for stock-feeding ..	15.1	9.6	12.4

The lifting of second early and maincrop *potatoes* was in progress in almost all parts of the country. The incidence of blight remained slight, except in some south-western districts; common scab was prevalent in several areas and second growth was also reported. The yield of second early and maincrop varieties was expected to be 8.1 tons per acre, as compared with a five-year average of 8 tons and a yield of 7.1 tons in 1958.

Lifting of *sugar-beet* had begun in most areas, but was difficult on hard, heavy land. Virus yellows had become widespread. The yield per acre of roots was expected to be about average.

All root crops and kale were adversely affected by the dry weather conditions. *Mangold* crops were variable; the yield was expected to be 18.3 tons per acre, compared with a five-year average of 23.1 tons and a yield of 24.6 tons in 1958. *Turnips* and *swedes* were badly affected by mildew and aphis attacks in many areas, and crops were poor; the yield was expected to be 11.7 tons per acre, compared with a five-year average of 15.7 tons and a yield of 16.5 tons in 1958. Some early sown *kale* crops were fairly satisfactory, but later sown crops were poor. Weed infestation and aphis attacks were reported from several areas.

Acknowledgment is made to *For. Crops. Mark.* and to *Spec. Reg. Inform Services* for much of the information contained in the above report.

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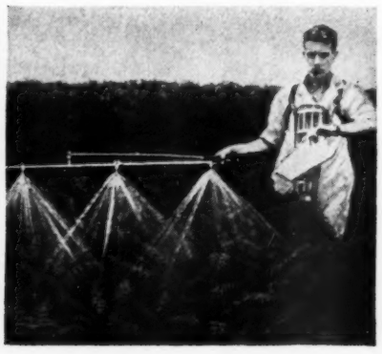

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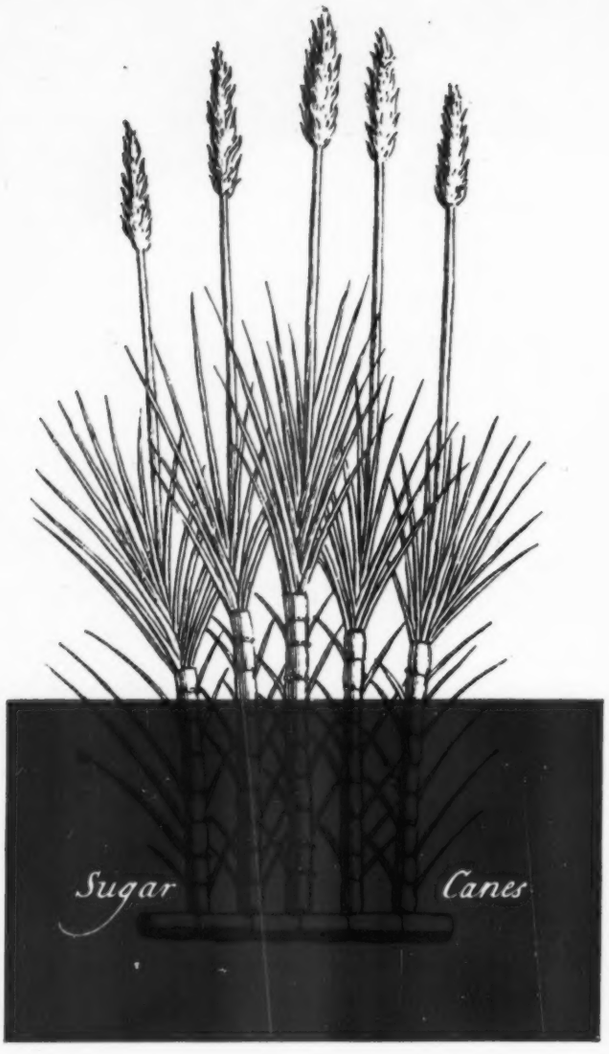

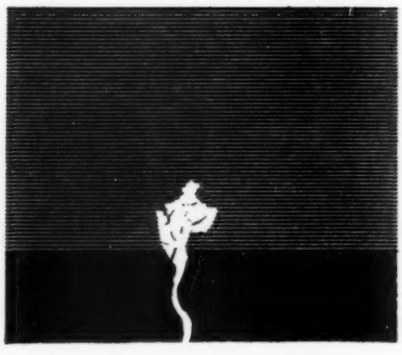

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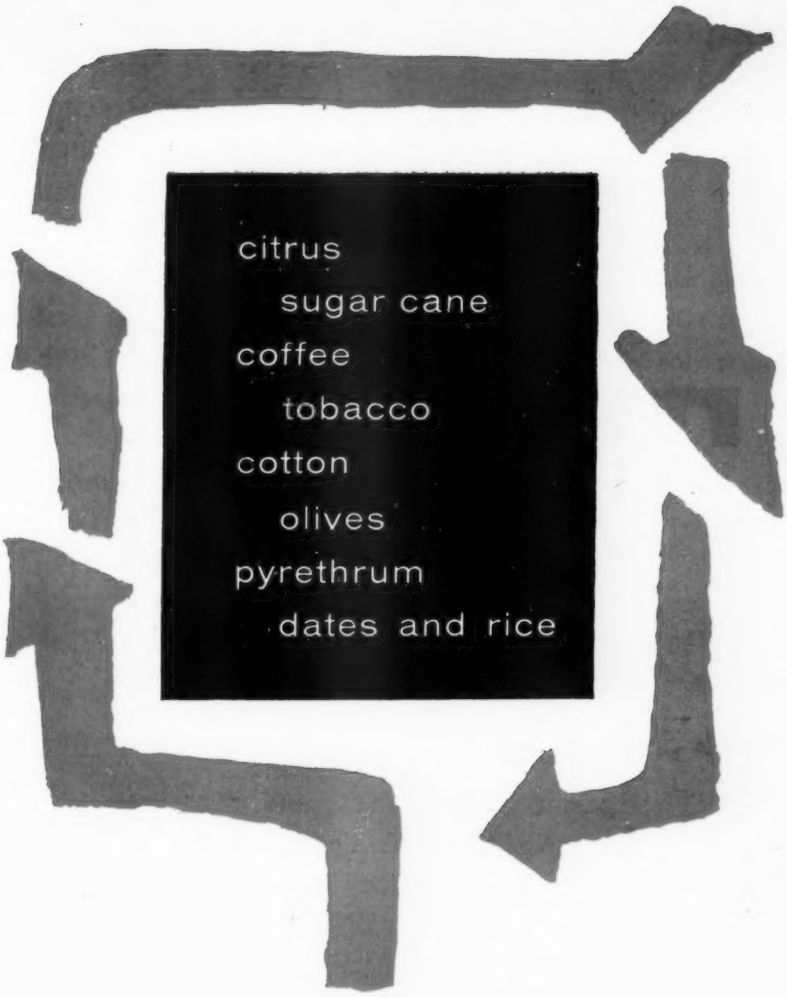

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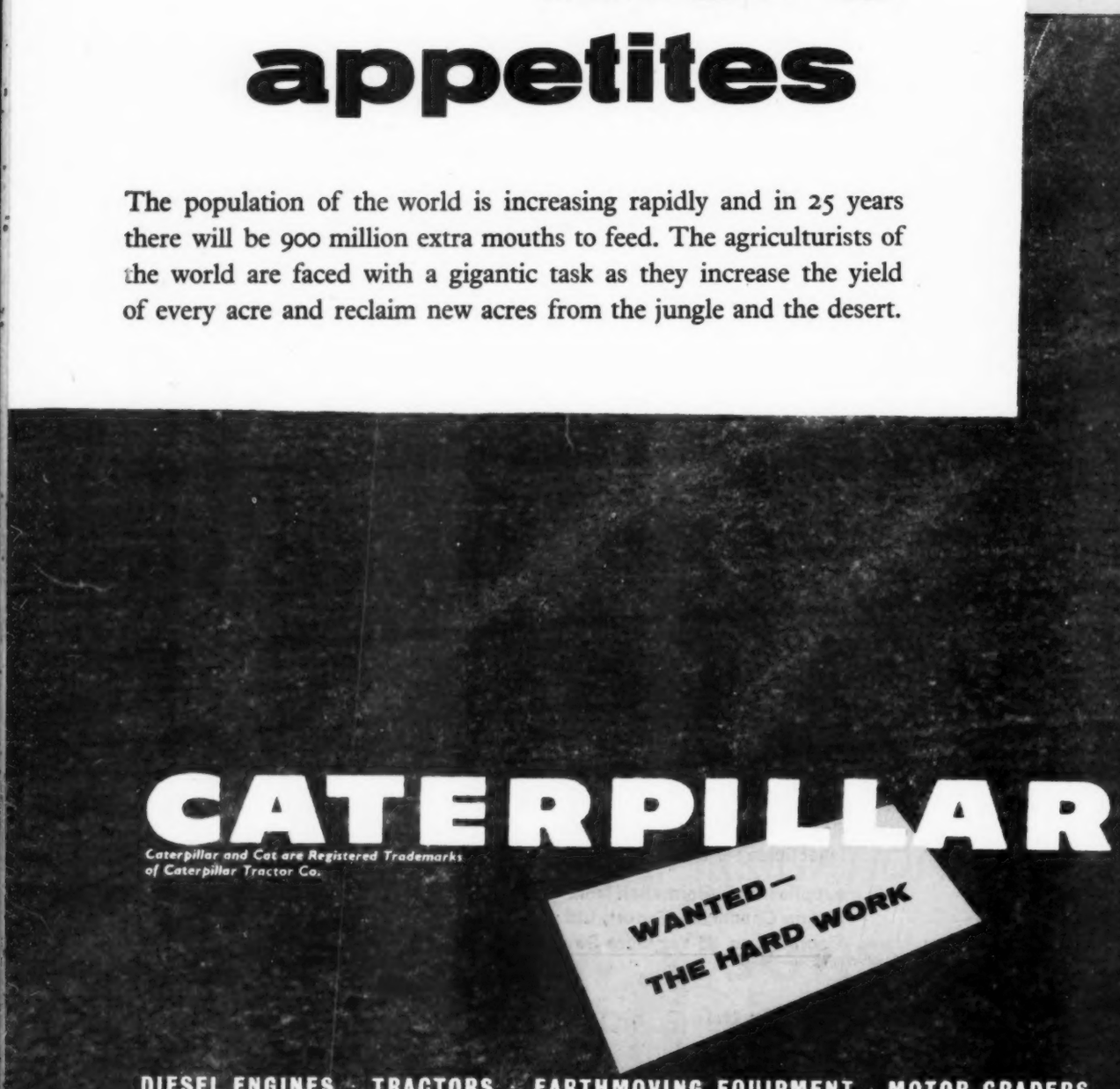
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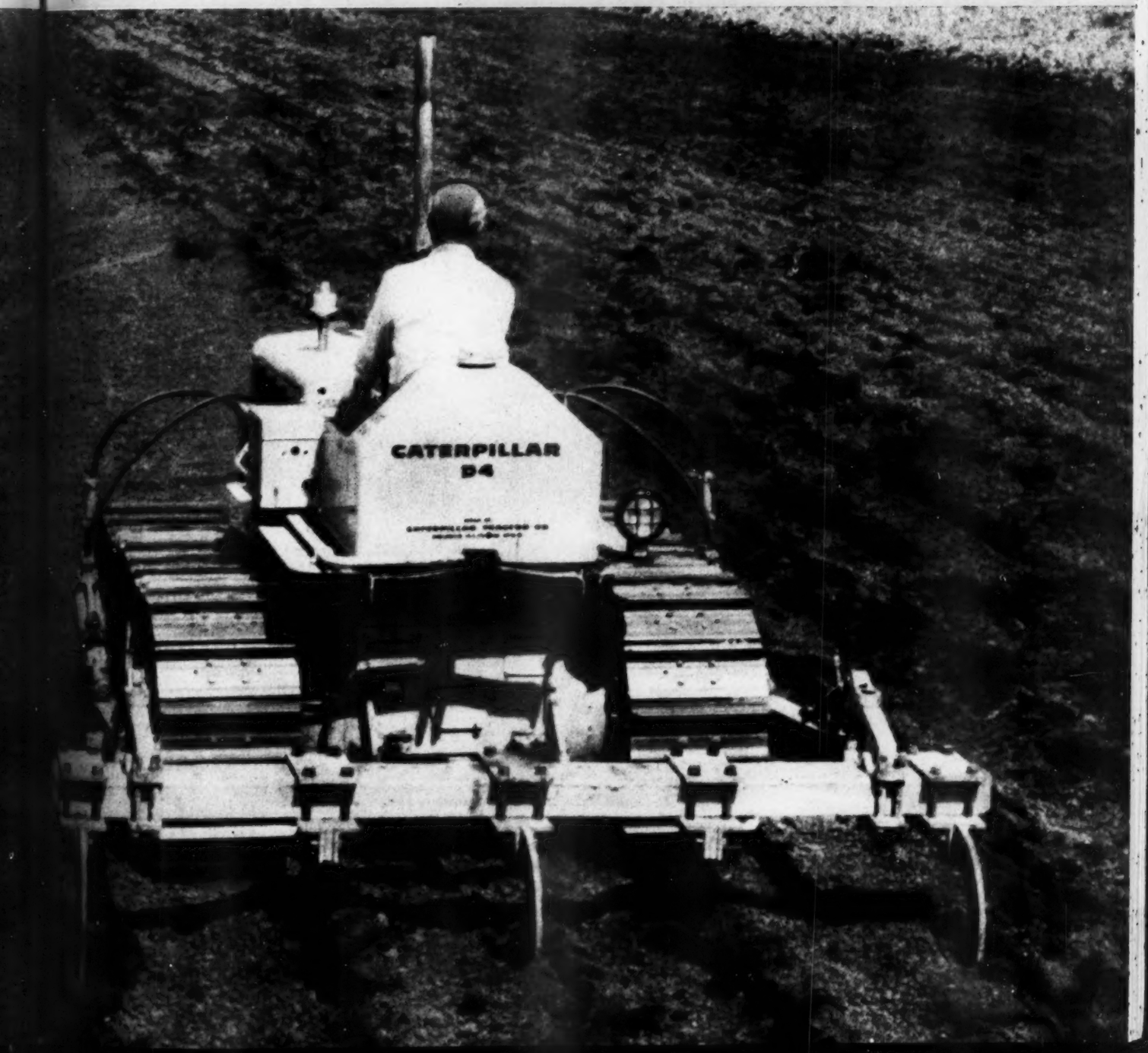

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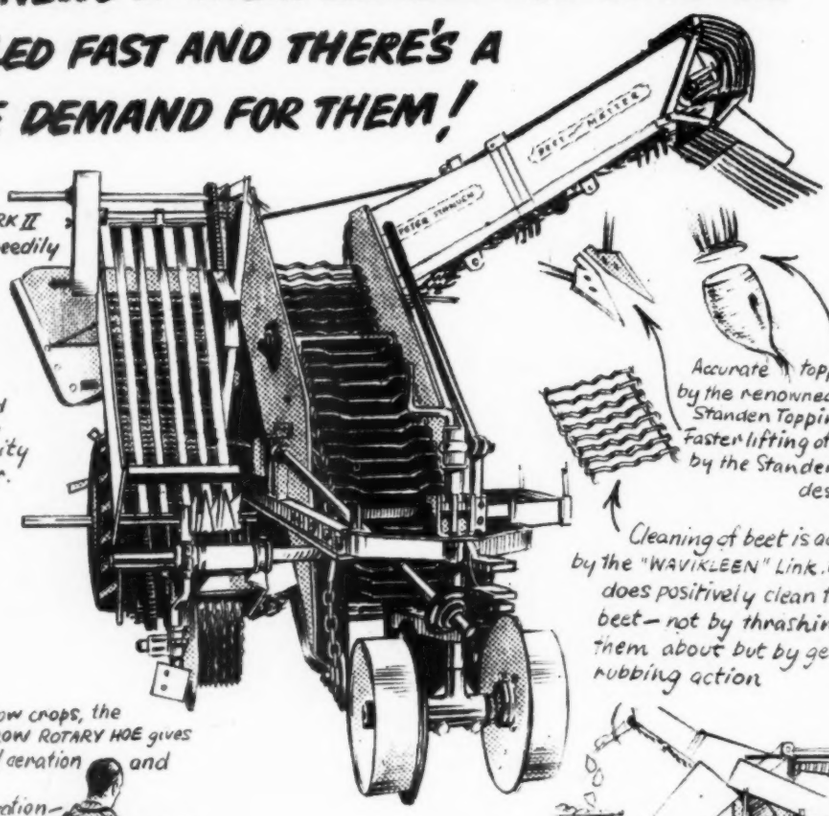

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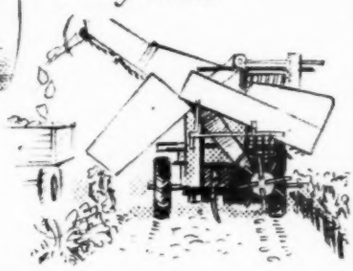
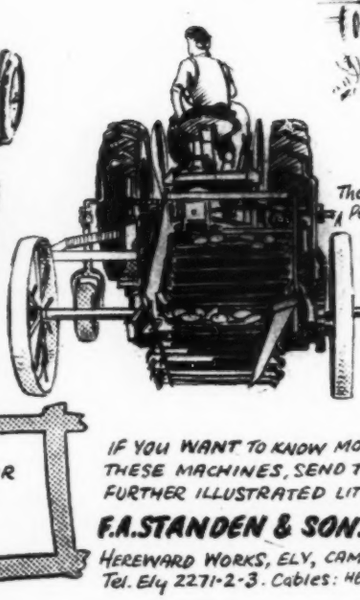


For hoeing between all row crops, the Peter Standen. INTER-ROW ROTARY HOE gives better weed control, soil aeration and promotes moisture conservation — thus ensuring bigger crop yields by more efficient cultivation



The Peter Standen POTATO DIGGER which cuts & cleans the haulm & leaves the potatoes clean & winarowed for easy picking up. This is definitely the most economical way to lift potatoes.'

IF YOUR ORGANISATION CAN HANDLE THE DEMAND FOR STANDEN MACHINES IN YOUR COUNTRY, WRITE TO: MR F.A.STANDEN, HEAD OF EXPORT DIVISION

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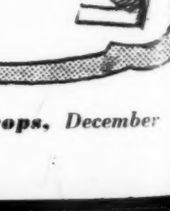

WT.58

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in agriculture . . . Operators use 'Jeep' vehicles to spread their cost over *more* jobs and increase their profits. Through three power take-off points, they supply *mobile power* to operate winches, generators, belt-driven machinery – and more! On steep mountain slopes, through dense vegetation, over deep-rutted roads, 'Jeep' 4-wheel drive traction takes you and your payload – *anywhere, anytime!* 'Jeep' vehicles are *functionally* designed . . . job styled for rugged work, on or off the road. That's why they give years of superior performance at low upkeep cost. See your 'Jeep' dealer or distributor for a demonstration on your job.

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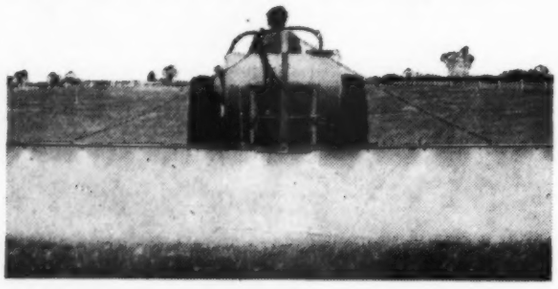
Buy an Allman Sprayer—you cannot buy a better.



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Estimates effect of rainfall

Improves yield and quality

Saves water and labour

No over-irrigation

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For Field, Row and Tree Crops WITH ALL METHODS OF IRRIGATION

Installed in the ground in representative areas at varying depths, Irrometers tell *when* and *how much* to irrigate in order to maintain optimum moisture throughout entire root zone. Increases yield and crop quality.

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Irrometer operates on tensiometer principle. It consists of a sealed, water-filled tube equipped with a vacuum gauge, with a porous tip installed in the ground at desired root depth zones. In dry soil, water is drawn out of the instrument, creating a partial vacuum which registers on the gauge. The drier the soil, the higher the reading. Irrigation reverses this action, resulting in a lower gauge reading. This unique principle of operation means that no calibrations are necessary under normal operating conditions for different soil types. Gauge continuously registers soil moisture.

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NEW Model "R"

Diameter now reduced to 7/8". Easier to install. Complete range of sizes: 6", 12", 18", 24", 36", 48".

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...WITH AMMO-PHOS-KO

Rice farmers throughout Latin America report that the use of Ammo-Phos-Ko has actually doubled their yields—and multiplied their net profit many times! Ammo-Phos-Ko is the one fertilizer that gives you a wide selection of formulations—in pellet form—for flooded rice. Pellets scatter easily by hand or by airplane.

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Flooded rice makes peculiar demands on a fertilizer. First, it must contain the proper balance of essential plant foods . . . ammonia nitrogen, phosphorus, potash (where soil is deficient) and sulphur. Second, these plant foods must be available quickly, since rice must have nourishment, particularly in the early stages of development. Ammo-Phos-Ko meets all these requirements—and more!

The nitrogen in Ammo-Phos-Ko is of a slow-acting, non-leaching ammonia form that feeds evenly from germination to harvest. Its phosphorus is all water-soluble and is immediately available. And Ammo-Phos-Ko contains more available sulphur than most other fertilizers—helps keep plants healthy and strong.

RECOMMENDED FORMULAS AND APPLICATIONS

For soils that already contain adequate potash, 16-20-0 at the rate of 200 kilos per hectare is most common. If the soil shows a marked phosphate deficiency, an Ammo-Phos formulation with more phosphate—like 13-39-0—should be used. For soils low in potash, Ammo-Phos-Ko 12-24-12 is usually best. Rate of application can vary greatly—from 150 to 300 or more kilos per hectare depending on the intensity of cultivation. Many rice growers apply Ammo-Phos-Ko three times for top efficiency.

Note: To assure maximum return from your Ammo-Phos-Ko investment, see your Mathieson Dealer for a free soil analysis and specific recommendations.

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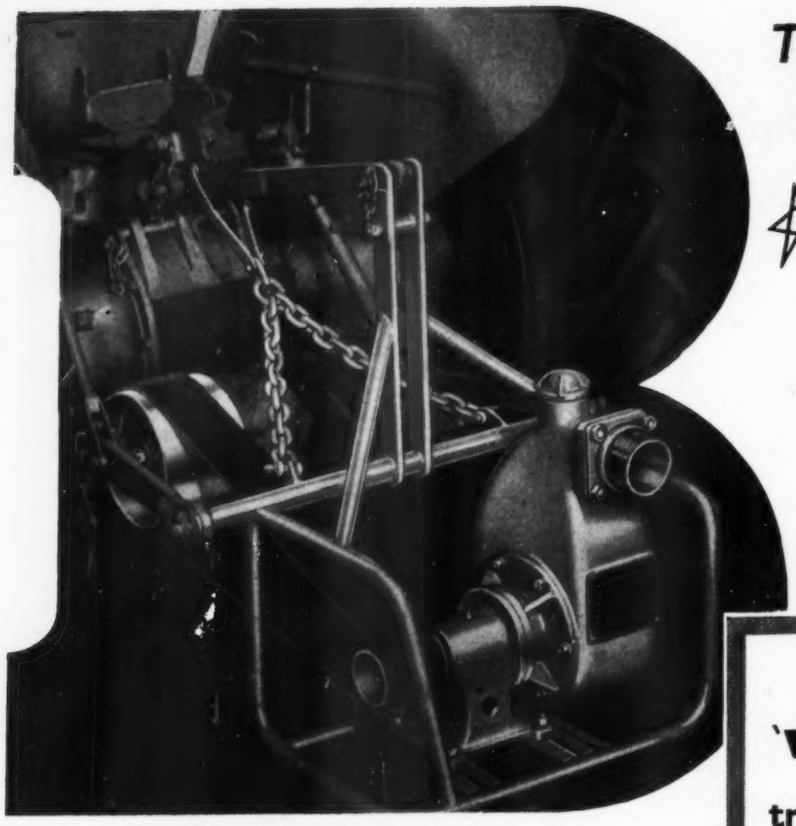

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You can use this inexpensive pump for 101 jobs on the estate or farm—in fact, wherever the tractor will go. Use it for irrigation, fire-fighting, pressure washing, pumping liquid manure, emptying ponds and excavations, filling tanks, washing root crops, etc., etc. It is self-priming and capable of 25 feet suction lift and a maximum capacity of 16,500 gallons per hour. It is easily and quickly attached to the Ferguson I or Fordson "Dexta" tractor hydraulic lift mechanism and driven by the power-take-off. It is a pump you should have available for everyday use and for any emergency, whether it be fire, flood or drought. Your Ferguson dealer can give you more details or we will be pleased to send you a descriptive leaflet.

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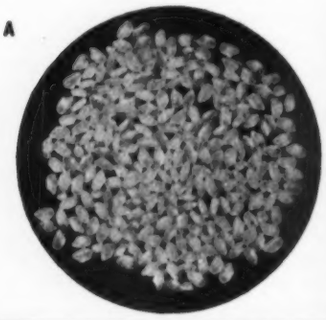

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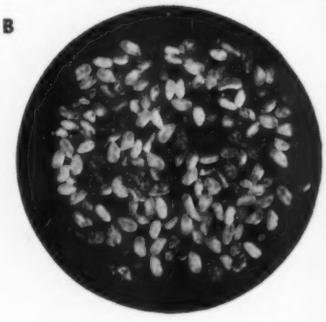

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Gunson's SORTEX machines separate small articles by colour, and with a high degree of accuracy under all climatic conditions.
SORTEX models are available for a wide range of commodities. These are grouped in size from articles of the order of mustard seed up to hazelnuts, almonds and other commodities up to half an inch.
A SORTEX machine is available for each group.

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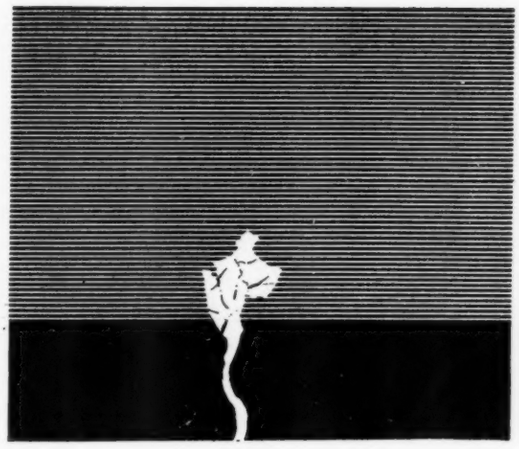
Worldwide patents



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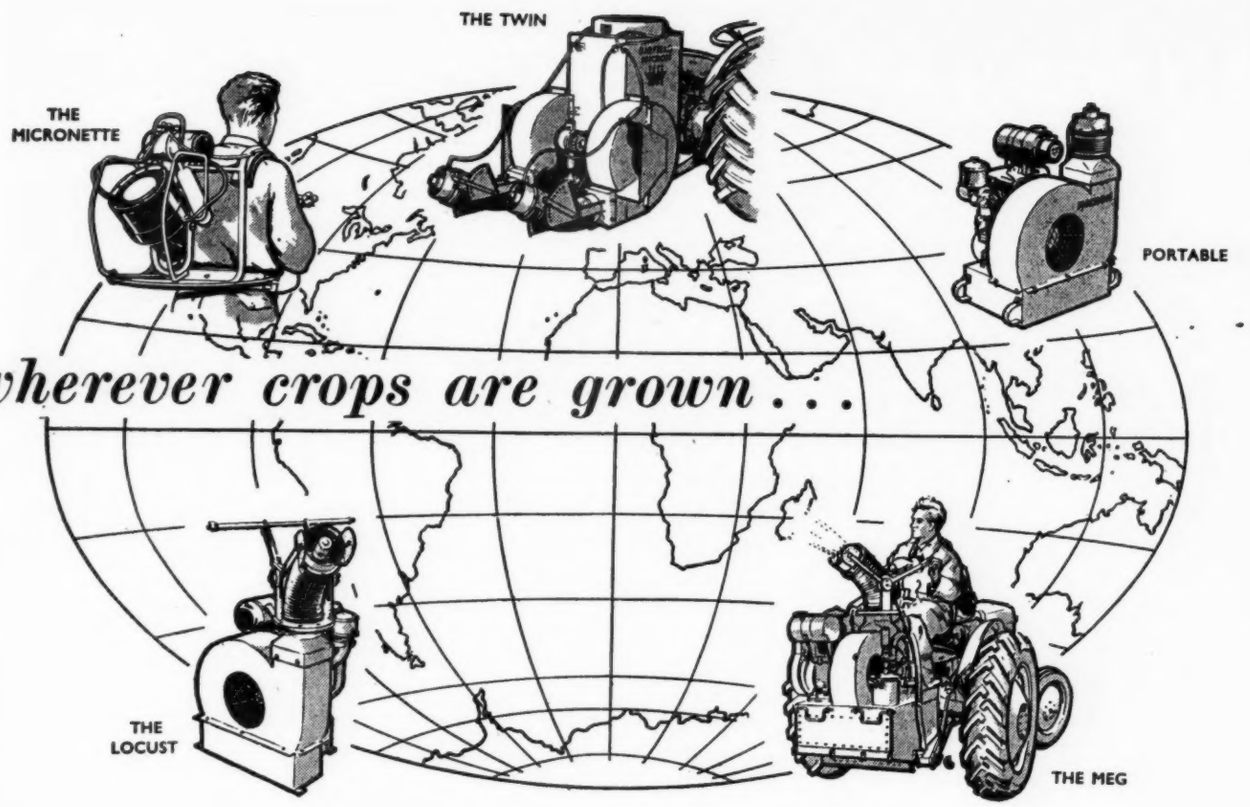

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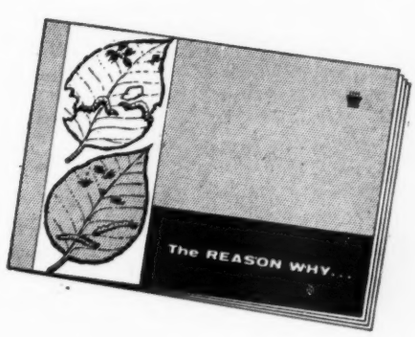

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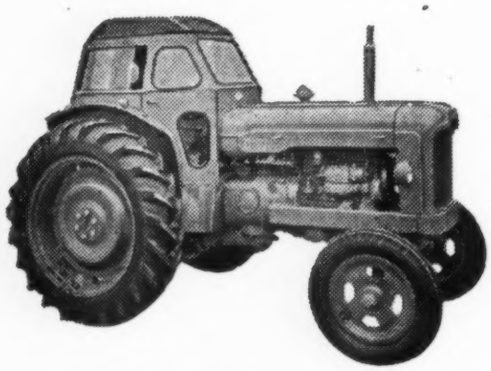

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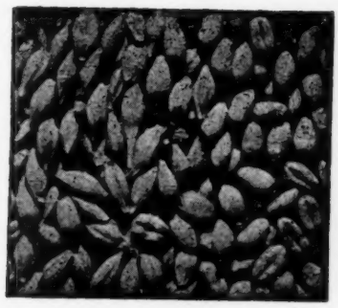

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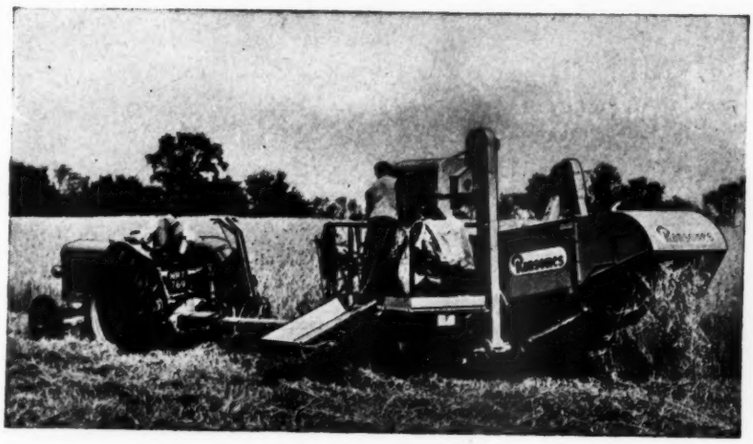
RANSOMES MST 56 TRACTOR COMBINE 5 FT. CUT



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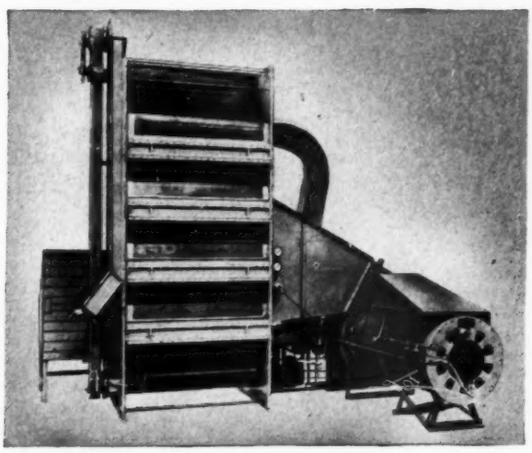

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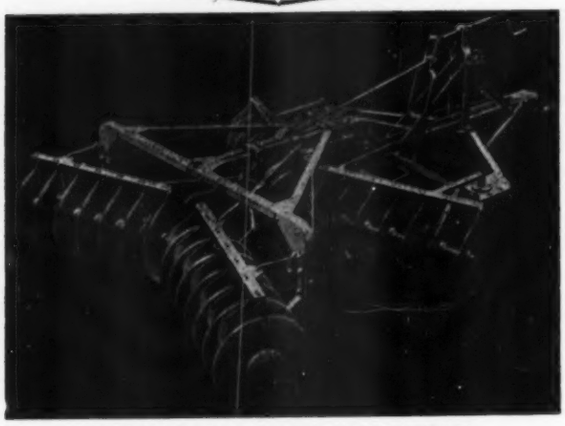

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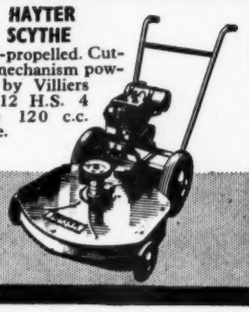

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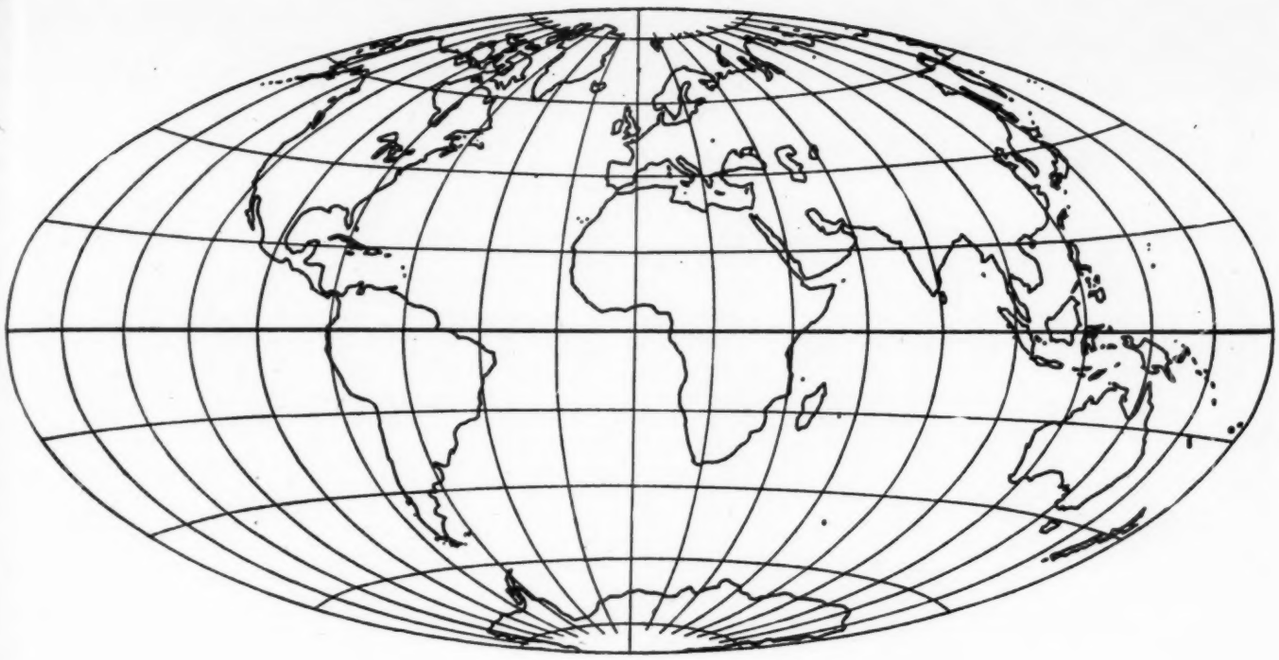

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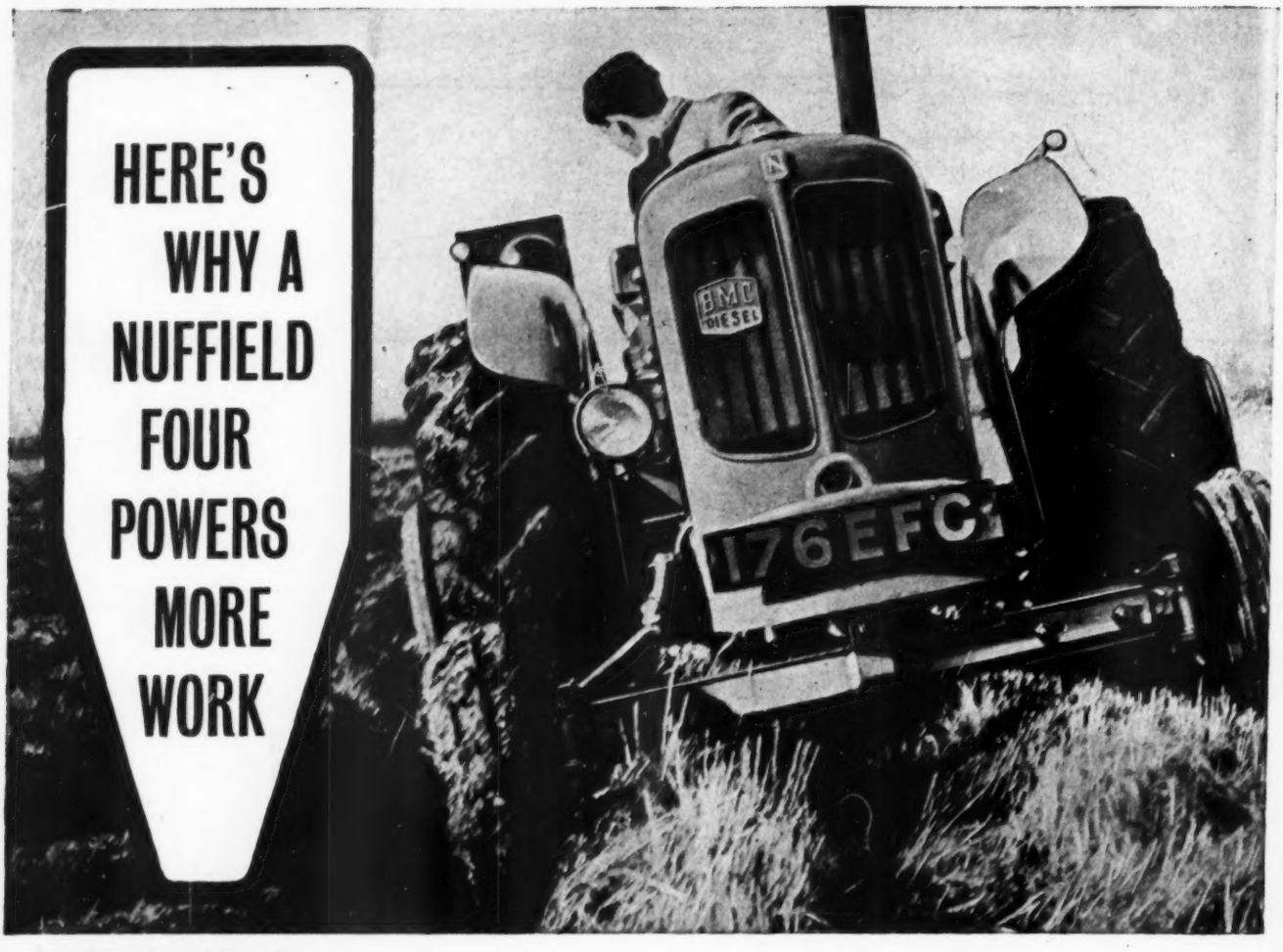

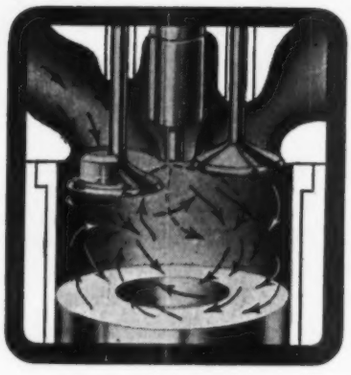

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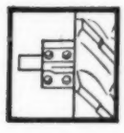

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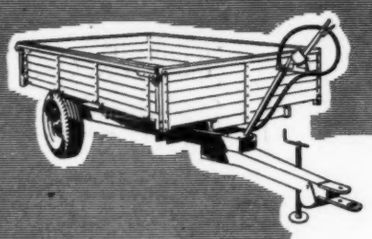

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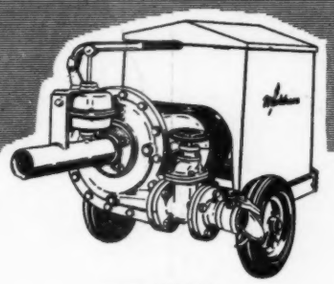

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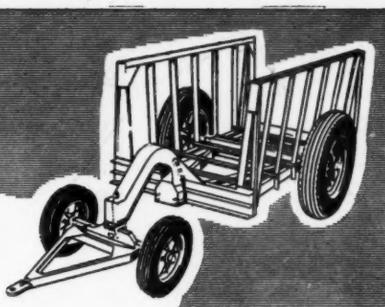

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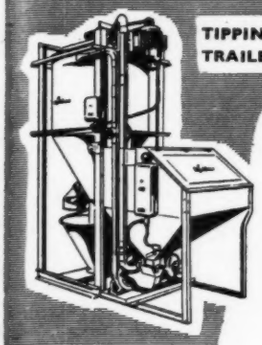
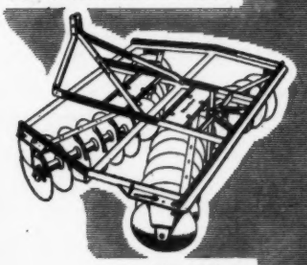
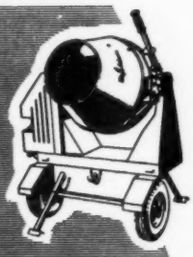


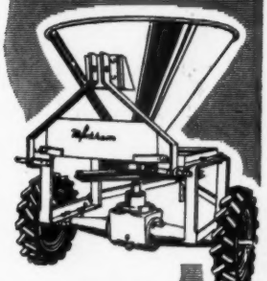
COMBINED MILL and MIXER



MOUNTED DISC HARROW



CONCRETE MIXER



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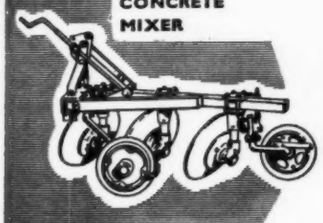

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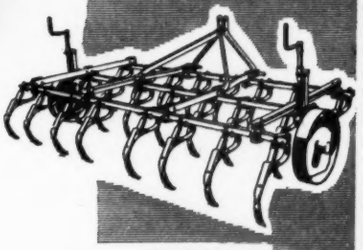

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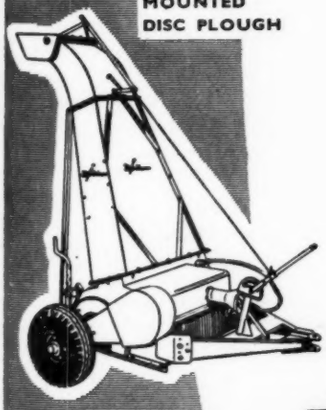

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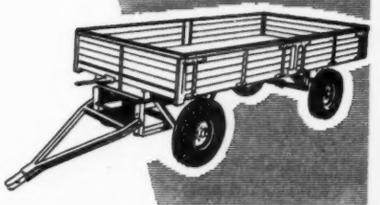

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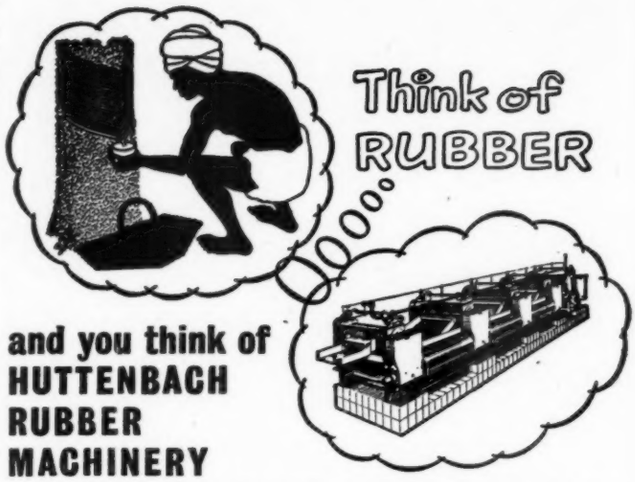

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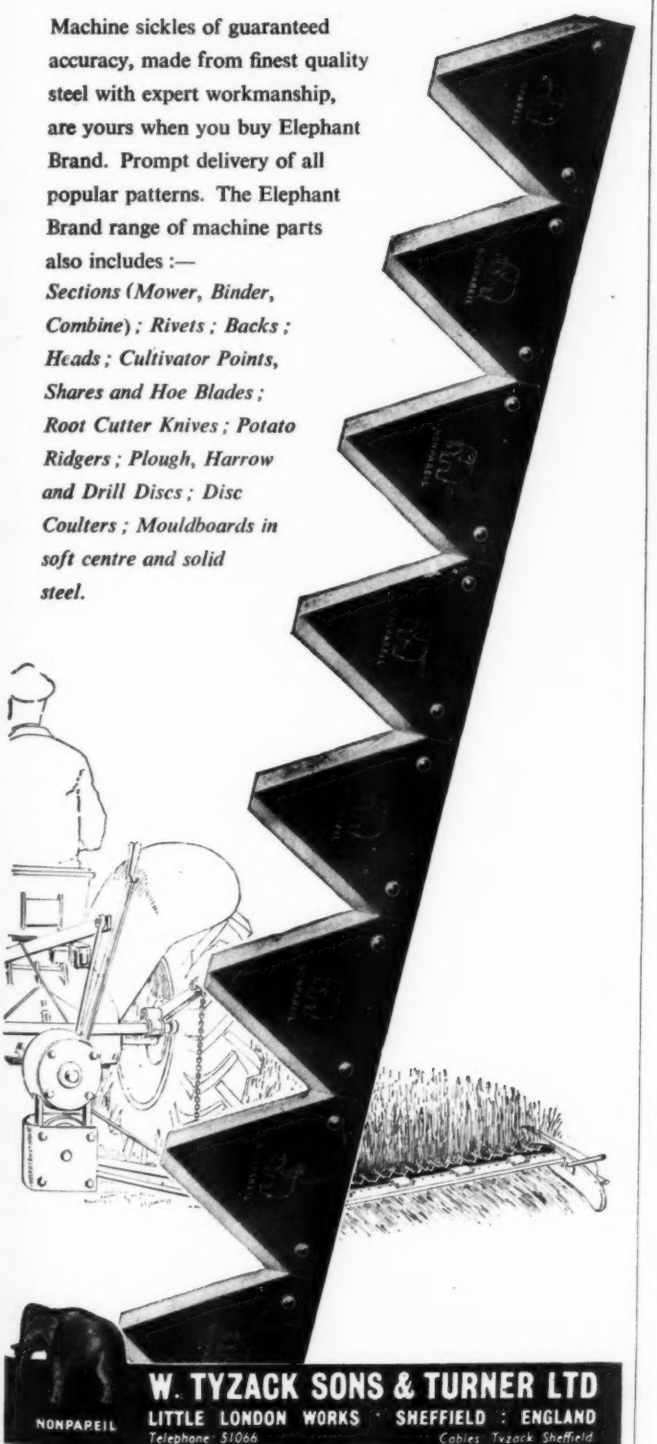

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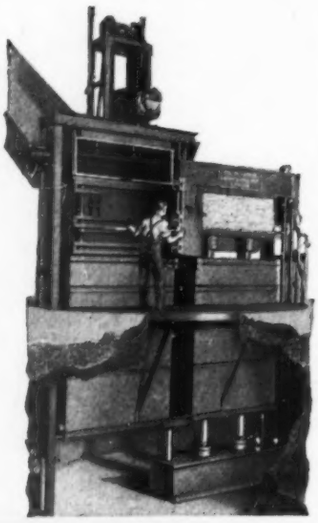

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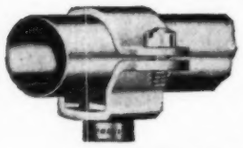

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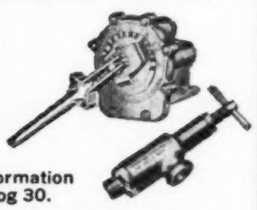

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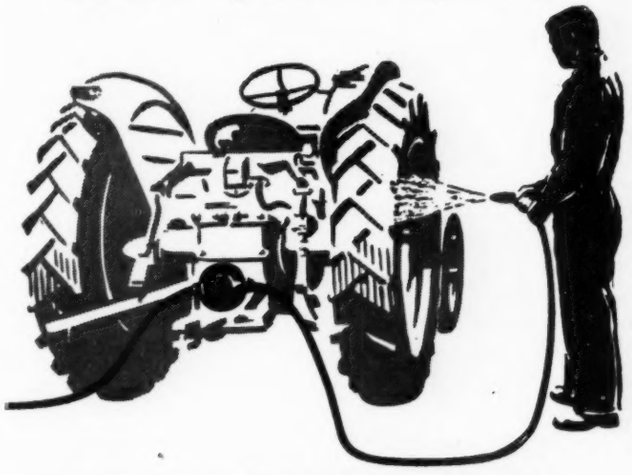

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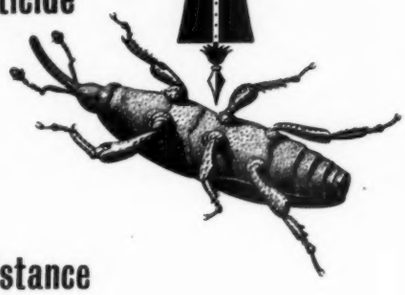

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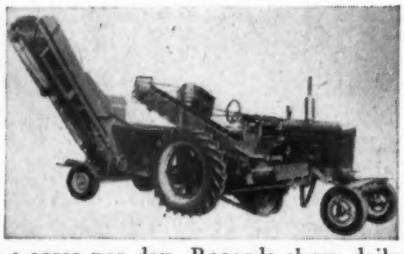

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I.S.I.S. is an organisation backed by a large industrial group of consultants with contacts in all the industries based on technology. As an addition to their present resources they have established this Appointments Register. Below will be found some of those technologists who are looking for further opportunities. Employers and Personnel Officers are invited to complete the form below, detach and send to the above address. In this particular instance the use of a form, with its attendant simplification of office systems, ensures speedier results for the employer.

Ref. A.65. British. Male. Married. B.Sc.(Eng.), Diploma Civil Engineering, A.M.I.C.E., M.E.I.C. Experience: 2 years civil engineering assistant airfield construction. 2 years assistant road engineer. 2 years chief design engineer. 2 years designing engineer. 3½ years superintendent of lights, Government of Canada. Approximately 7 years of career has been in roads and highways—materials, traffic, resident engineer, design engineer, etc. Responsible 7 million dollars' worth of construction work annually on major highways—Canada. Last 3 years has held responsible senior position concerned with aids to navigation and other marine work. Is now seeking a Permanent Senior Appointment in Civil Engineering —roads, general construction or administration— in London.

Ref. A.66. British. Male. Age 36. Married. A.M.I.E.D. 4 years apprentice with aircraft accessories company. 5 years design draughtsman with same company. 1 year design draughtsman gas control equipment. Design engineer with industrial consulting company. 5 years self-employed as industrial consultant. Experienced in all types of mechanical design and in control of a mixed drawing office. Security cleared. Now seeks Permanent Appointment London Area as Chief Draughtsman or Assistant Chief Draughtsman. Considers prospects more important than salary. Suggests commencing salary of £1,200 per annum.

Ref. A.64. British. Male. Age 48. Married. Experience: 3 years senior mineral boring engineer. 8 years drilling manager. 2 years drilling supervisor. 8½ years driller supervisor petroleum company. 3 years trainee with petroleum company. Now seeking permanent position U.K. or abroad as Drilling Manager.

Ref. A.68. British. Male. Age 31. B.Sc.(Eng.) Mechanical Engineering. 9 years with aircraft and guided weapon contractor as assistant project engineer. Has undertaken free lance consulting work —chemical engineering. Ran own business for 2 years manufacturing water filters. Now seeking appointment in Technical Management, Pure Research or Technical Sales in U.K., preferably London or West Home Counties, but would consider elsewhere. Would be interested in trainee scheme for technical management of sales. Salary required £1,200 per annum.

Ref. A.71. Irish. Male. Age 23. Single. Just graduated B.E. (Chemical) degree, Dublin. At present studying economics and costing methods in spare time. Now seeking permanent appointment U.K. or abroad as Chemical Engineer—process development or production. Salary £700.

Ref. A.72. Australian. Male. Age 30. Single. Production Engineering Diploma. Grad.I.Prod.E. At present tool and production engineer. Previous experience: 1 year planning engineering telecommunications. 1 year design draughtsman—domestic appliances. 2 years methods engineer mechanical rubber goods. 2½ years production plan and control trainee—electro-mechanical products. 3 years precision engineer. Apprenticeship. Has worked U.S.A. and Australia. Now wishes to settle permanently in Britain and requires post as Production Engineer, London area.

Ref. A70. Irish. Male. Recent Graduate, Dublin, Chemical Engineering. Now seeking post U.K. or abroad as Chemical Engineer with salary of £700 per annum.

Ref. A.76. British. Male. Age 56. Married. Graduated Electrical Engineer, Graduated Electronic Engineer. 2 years lecturer at University—tutorial and laboratory classes. 7 years sound recordist film factory. 1 year electronic engineer audio laboratory. 2½ years senior engineer electronics. 3½ years senior designer. Post graduate courses in pulse technique. Seeks post as Senior Research Engineer, Middlesex or London. Salary £1,400 per annum.

Ref. A.77. British. Male. Age 25. Married. Second Year National Aero Engineering Certificate. At present employed electrical design—aircraft industry. Previous experience includes 8 months jig and tool draughtsman and 3 years R.A.F. engine turbine fitter. In present post has carried out extensive liaison work and has been instructor (L.C.C. evening classes) on aero engines. Now seeks post London or Home Counties as Technical Representative. Salary £900 per annum.

Ref. A.78. British. Male. Age 49. Single. Experience: 18 years designer with exhibition contractors. 6 years draughtsman, Ministry of Supply. 6 years Patner Exhibition contractors. 2 years draughtsman tyre and rubber manufacturers. Seeks appointment in Surrey with salary of £1,000—£1,250 per annum.

Ref. A.79. British. Male. Age 40. Married. F.R.I.C., B.Sc.(Spec.) Chemistry and Mathematics. Experience includes 4 years assistant plant manager—soaps, detergents, chemicals and edible oils. 2 years plant manager soap, detergents, chemicals and edible oils. 4 years same field as technical director, Africa. 2 years same industry development manager, India. Now seeking senior appointment with excellent prospects requiring technical skill and experience. Salary £3,000 per annum.

Ref. A.80. British. Male. Age 53. 5 years marine engineering apprenticeship. 5 years 6th, 5th, 4th engineer tanker company. 2 years structural engineer oil company. 2 years structural and installation engineer colliery. 2 years structural and installation engineer Scottish company. 4 years structural and works foreman, petroleum company. 5 years war service in Merchant Navy as salvage engineer. 1 year production engineer dynamo company. 2 years field engineer and 2 years resident engineer oil company in East Africa. 4 years design and development engineer Sudan. 2 years field engineer petroleum company Pakistan. Inventor of a cotton 'stalk pulling machine.' Now seeking a post as Field or Works Engineer, preferably U.K. but would consider abroad. Salary £1,200—£1,500.

Ref. A.81. British. Male. Age 37. Married. Educated to H.N.C. Standard. Assistant Member Institute Materials Handling. Experience: Including 12 years chief draughtsman—mechanical handling. 1 year as executive engineer with consultants. Is experienced in all forms of materials handling and mechanical handling equipments, both for bulk and package handling, covering complete X range from foundry plants to food handling equipments. Knowledge of technical sales. At present assistant general manager with mechanical handling company. Now seeking Executive Post in Materials Handling. London area. Salary £1,500.

Ref. A.82. British. Male. Age 30. Married. Final diplomas Institute City & Guilds Chemistry, Bacteriology, Production and Processing, Milk and Milk Production. Experience: 6 months factory manager—dairying. 4½ years factory manager, large processing dairy. 3½ years dairy inspector with dairying group. Has attended management school for senior executives and managers, Natal University. Currently studying for C.I.S. Has wide general food technological interest; keen on production, processing, etc. Now seeking a management appointment overseas, except South or East Africa, or U.K. (Provinces), with U.K. salary of £1,000 per annum. Would also be interested to join management trainee scheme.

Ref. A.83. British. Male. Age 39. Married. Associate Member of Institute of Industrial Technicians. Member of the British Ceramic Society. Member of Institute of Clay Technology. 2 years management course. At present employed in atomic research (ceramics). Experience: 6 years ceramics engineer, sparking plug manufacturers. 17 years with crucible manufacturers. Ceramics trainee, foreman. Senior works study engineer. Now seeking appointment on Management Staff in Ceramics Industry or other Processing Industry in Home Counties or South or South-West England. Salary £1,500 per annum.

Ref. A.94. British. Male. Age 37. Married. Experience: 5 years apprentice fitter and turner, Admiralty. 4 years shift charge engineer (power stations), Admiralty. 1½ years draughtsman engineering company. 3 years design draughtsman—hydraulic engines. 8 years general manager—mechanical engineers. At present assistant engineer with consulting mechanical engineers. Seeks appointment as Technical Representative or Works Manager. U.K. Salary £800 per annum.

continued overleaf

To: I.S.I.S. Appointments Register, 9, Eden Street, London, N.W.1. Please ask the following applicants to communicate with the undersigned:

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Signature..... Date.....

I.S.I.S. APPOINTMENTS REGISTER—*continued*

Ref. A.95. German. Male 45. Mechanical Engineer Certificate. Skilled locksmith with experience in engine repair, and electric arc welding. Experience 7 years as locksmith. 6 years engineer. 2 years engine service. 3 years service and sales experience in automobile fabrication. Seeks appointment U.K. or West or East Africa or Middle East as Mechanical Engineer, willing to begin as locksmith.

Ref. A.96. British. Male. Age 44. A.M.I.Mech.E. Experience: 8 years as apprentice and junior section leader with engineering company. 4 years Army as electrical and mechanical engineer. 3 years design engineer. 6 years chief designer with manufacturing engineers of contractors plant and general mechanical /structural products. Seeks post U.K. (Midlands preferred) as Chief Engineer/Chief Designer. Salary £1,750—£2,000.

Ref. A.97. British. Male. Age 37. Married. A.M.I.Mech.E. 2½ years apprentice and fitter turner. 3½ years jig and tool draughtsman—car body engineers. 1½ years mechanical draughtsman with general engineers. 3 years senior draughtsman with mechanical handling engineer. 2 years materials handling engineer with general engineers. 2 years chief contract engineer with materials/mechanical handling engineers. Seeks appointment London area as Technical/Contract/Sales Engineer, preferably in materials/mechanical handling. Salary £1,300.

Ref. A.98. British. Male. Age 26. Single. A level G.C.E. Physics, Pure Mathematics, Applied Mathematics and Chemistry. City & Guilds (Intermed.) Instrument Maintenance. Experience: 4 years technical commission R.A.F. 2 years development assistant with instrument company. Seeking appointment in the Instrument Field (not electronics), where opportunity will be given to develop knowledge of instrumentation on broader lines and encouragement for continued study. Salary £750 per annum.

Ref. A.99. British. Male. Age 22. Married. Higher National Diploma in Mechanical Engineering. Experience: 6 months fitter and turner. 6 months draughtsman and 6 months assisted site engineers with steel manufacturers. Seeks permanent appointment as Plant or Development Engineer. U.K. (preferably London). Salary £700—£750.

Ref. A.100. British. Male. Age 24. Single. B.Sc. (Chem.). Prior to H.M. Forces spent 2 months as technical sales assistant with paper and plastics engineers. Since joining Army has undergone course in electronics and is now an instructor in radar and works on radar inspection team. Seeks post in Technical Sales or Liaison in Italy. Salary £700 per annum.

Ref. A.101. British. Male. Age 36. A.M.I.E.E., B.Sc., H.Nat.Cert.Elec. 1½ years apprentice engineering company. 2 years technical assistant electrical rolling stock—railway. 2½ years technical sales. 9 years electrical and instrument engineering with chemical and metals manufacturer. Seeks appointment Technical Sales or Works Engineer or Electrical or Chief Engineer. London area. Salary £1,750 per annum.

Ref. A.102. British. Male. Age 31. R.E., R.E.A., H.E.C. (Royal Navy) N.A. 1 year radio telemetry engineer. 13 years radio electrical artificer, Admiralty. Seeks post in Electron Beam Generating. U.K. or Japan. U.K. salary £1,500.

Ref. A.84. British. Male. Age 41. Married. Mech. Eng. up to N.H.C. 7 years apprentice—aircraft. 2 years charge hand—aircraft. 3 years works superintendent heavy diesel engine manufacture. 4 years section leader over production development. 2 years works manager, machine tools. 2½ years works manager, general engineering. At present general manager, special purpose machine design. Seeks appointment U.K. or abroad. Salary £1,500 minimum.

Ref. A.85. British. Male. Age 26. Married. O.N.C., 2nd Class M.O.T. Cert. (Motor). 5 years 10 months general apprentice pattern shop, foundry and drawing office. At present 2nd engineer officer in charge of all engine room personnel. Seeks Technical/Supervisory Appointment. Anywhere except Middle East. Salary £1,000.

Ref. A.86. British. Male. Age 30. O.N.C. (Mechanical), H.N.C. (Production), Production Control Course, A.M.I.Mech.E., Grad.I.Prod.E. 6 years apprenticeship mechanical and general engineers. 7 months mechanical draughtsman, mechanical and general engineers. 6 months production design draughtsman, electrical mechanical engineers. 6 years senior factory planning engineer, responsible for planning, work study, rate fixing, methods, etc., with aero and marine engine manufacturers. Seeks post as Assistant Works Manager, London or Home Counties or Southern England. Salary £1,300.

Ref. A.87. British. Male. Age 28. Married. Ministry of Transport 1st Class Certificate Marine Engineering (Steam), A.M.I.Mar.E. to be applied for. At present studying for National Certificate in Electrotechnology final year. Experience: 2 years 4th engineer. 5 years 3rd engineer. 5 years apprentice fitter-turner, rayon manufacturer. Seeks appointment U.K. in General Engineering. Salary £850 per annum.

Ref. A.89. British. Male. Age 39. Married. S.C. & H.N.C. (Electrical). Associate Member of Institute Technology. 4 years tester electrical manufacturers. 6 years engineer in charge laboratory, Divisional H.Q. British Electricity Authority. 4 years development engineer, meter, relay and instrument manufacturer. 3 years senior assistant engineer, design and development and production electricity meter and instrument manufacturer. Seeks appointment as Design, Development or Test Engineer with Manufacturers in London. Salary £1,150—£1,200 per annum.

Ref. 90. British. Male. Age 43. Married. 6 years apprenticeship aircraft manufacturers. 5 years machine shop foreman—carburettor manufacturers. 1 year area inspector Civil Service (Marine). 7 years works foreman—general engineering. 3 months works manager, aircraft engineering. 6 years machine shop foreman, aircraft and marine engines. Seeks post as Machine Shop Foreman/ Superintendent, Northern England (Lancashire preferred). £850—£1,000 per annum.

Ref. A.91. British. Male. Age 33. Married. O.N.C. (Elec.) Level. 5 years apprentice, electrical company. 4 years draughtsman, electrical company, 3 years draughtsman. 1 year checker and at present service engineer with furnace manufacturers. Used to handling skilled labour. Completed installations abroad. Seeks post London or provinces as Assistant Plant Engineer or Assistant Works Engineer, etc. Salary £1,000 per annum.

Ref. A.93. British. Male. Age 32. Married. High School Certificate Chemistry and Physics. Has reached B.Sc. standard in chemistry by part-time study. Experience: 2 years radar mechanic. 2 years laboratory assistant with linoleum and rubber manufacturers. 4½ years assistant plant manager with company manufacturing agricultural chemicals. Assistant works manager for 2½ years with chemical manufacturers. 2 years as plant manager with chemical manufacturers. Seeks appointment London or provinces as Production/Works Manager. Salary £1,500.

Ref. A.104. British. Male. Age 34. Married. O.N.C. standard (technical chemistry). 4 years works apprentice—coal (tar by-products). 10 years oil (petroleum refining) as process supervisor and refinery area supervisor. 3 months commissioning engineer, manufacturers of process plant. Seeks appointment Supervision of Chemical Plant, anywhere except Middle East or Africa. Salary £1,400.

Ref. A.105. British. Male. Age 39. Married. Experience: 7 years laboratory technician with research laboratories. 4 years senior inspector, radar and general electronics. 1 year chief inspector precision engineers. 3 years chief inspector. 1 year senior mechanical inspector electronic instruments. Seeks post as Chief Mechanical Inspector or Technical Representative. U.K. (preferably London area). Salary £900 per annum.

Ref. A.106. British. Male. Married. Age 29. O.N.C. (Elec.), C. & G. (Elec.), Institute 'B' Certificate. 2½ years apprentice electrical engineer, electrical assembly and repair. 2½ years apprentice electrician—factory maintenance—tin box and steel drum manufacturers. 1½ years seagoing chief electrician. 6 years seagoing and staff electrician Seeking an appointment in Electrical Engineering, preferably Merseyside, but would consider post anywhere if prospects were sufficient, would be prepared to take training course in new field if necessary. Salary £900 per annum.

Ref. A.107. British. Male. Age 40. Married. B.Eng. (Mech. Elect.), B.Sc. (Applied Tech.), M.Eng.A.M.I.Mech.E. Experience: 1 year works engineer, textile plant, Ireland. 2½ years maintenance development engineer, chemical manufacturers, U.S.A. 2 years lecturer, university and technical. 1 year manager, director, chemical manufacturing company, India. 1 year assistant professor engineering during university U.S.A. 2 years senior staff engineer, maintenance chemical manufacturers, U.S.A. Seeking appointment as Manager Development or Maintenance Engineer in the Chemical or Other Industries, preferably Far East. Salary £2,500.

Ref. A.108. British. Male. Age 34. Single. Professional qualifications equivalent A.M.I.Mech.E. Works experience: All branches of design and development in the light/medium engineering field. For last 7 years various executive engineering, managerial appointments—production control, works and office management, sales and market research. Now seeking progressive appointment as General Manager, Works Manager, Technical Director or similar. Salary £2,000 per annum minimum.

Ref. A.109. British. Male. Age 26. Married. Inter. B.Sc., Part 1 B.Sc. 3 years assistant chemist, preserve and confectionery manufacturers. 5 years laboratory assistant (antibiotic research). At present assistant chemist with fine couverture and chocolate manufacturers. Seeks appointment London or Home Counties preferred, as Production Manager, or Trainee Production Manager, preferably food industry. Salary £800 per annum.

Ref. A.110. British. Male. Age 30. G.I.Mech.E., Grad.I.Prod.E. Mechanical engineering apprenticeship followed by 3 years in workshops as fitter, then experimental mechanics. 2½ years as technical assistant on production development with electric cable makers. Seeking appointment London, Kent, South England, Production Management, Engineering Development or Production. Salary £950 per annum.

Ref. A.111. Danish. Male. Age 24. Single. M.Sc. from Danish Technical High School. 2½ months as technical assistant, glassworks, France. 1½ years chemist, brewery. 1 year chemist, feeding stuff laboratory. Seeking appointment U.K., South American or Far East as Chemical Engineer. Salary £900—£1,200.

Ref. A.112. British. Male. Age 31. Single. G.C.E. 'A' Level, Chemistry, Pure and Applied Mathematics. Also passed mathematics paper L.Sc. General Examination. 1 year technical clerk, brewers. 5 years analyst in metallurgical work. 2 years radio and electronics. 7 months analyst pharmaceutical chemists. Seeks post London in Chemical or Electronic Laboratory work. Salary £700—£800.

Ref. A.114. British. Male. Age 28. B.Sc.(Mech. Eng.). Experience: 1 year teaching mathematics. 2 years maintenance engineering food manufacturers. 14 months service engineer food machinery manufacturers. Seeks appointment as construction and maintenance engineer. Salary £900.

Ref. A.115. Polish. Male. Age 40. Chemical engineer. 1 year control of laboratory production photochemical materials. 1 year in charge chemical department import-export firm. 3 years deputy director department of cellular concrete, head of department of mechanical equipment, head of department of technology with institute. 1 year head of design office of building materials plant. 2 years research technologist housing institute. 1 year head of department of building materials, light industry institute. 2 years in charge pilot plant, research and development organisation. Seeks appointment London or Europe, except Germany or Eastern Europe. Salary £1,500 minimum.

Ref. A.116. British. Male. Married. Age 36. H.N.C. (Mech. Eng.), Associate Member of the Institution of Engineering Designers. Experience: 4½ years general engineering apprenticeship. 1 year draughtsman, armaments and vehicle chassis manufacturers. 2 years, draughtsman, precision tool and machine designers. 2 years draughtsman, marine ventilation engineers and fan makers. 6 years design draughtsman, pneumatic drying plant designers and suppliers. Seeks post as Mechanical Engineer. Salary £1,050-£1,250 per annum.

Ref. A.117. British. Male. Age 23. Married. Mechanical engineer. 4 years apprentice, marine engineers. 2 years apprentice and journeyman, mechanical engineers (mining). At present engaged in work study, R.A.F. Now seeking appointment in Work Study or as a Technical Sales Representative. Salary £600.

Ref. A.118. British. Male. Married. Age 27. Knowledge French, German and R.S.A.I. Russian. Last 7 years employed as fuel technician, iron and steel company. Seeks posts as Translator, using languages as above, U.K. Salary £900.

Ref. A.119. British. Male. Age 24. Single. G.C.E. Physics, Chemistry and Mathematics. E.I.M. Certificate in Foremanship and Supervision. 3 years meteorological assistant. 6 months routine quantitative analyst, photographic company. Seeks post as Laboratory Technician or Assistant, London area, N. or N.W. preferred. Salary £700 p.a.

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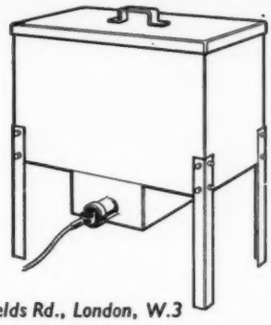

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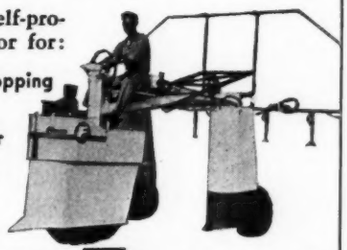

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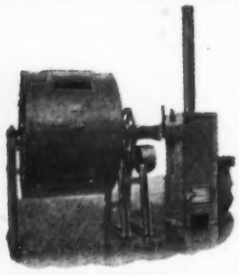

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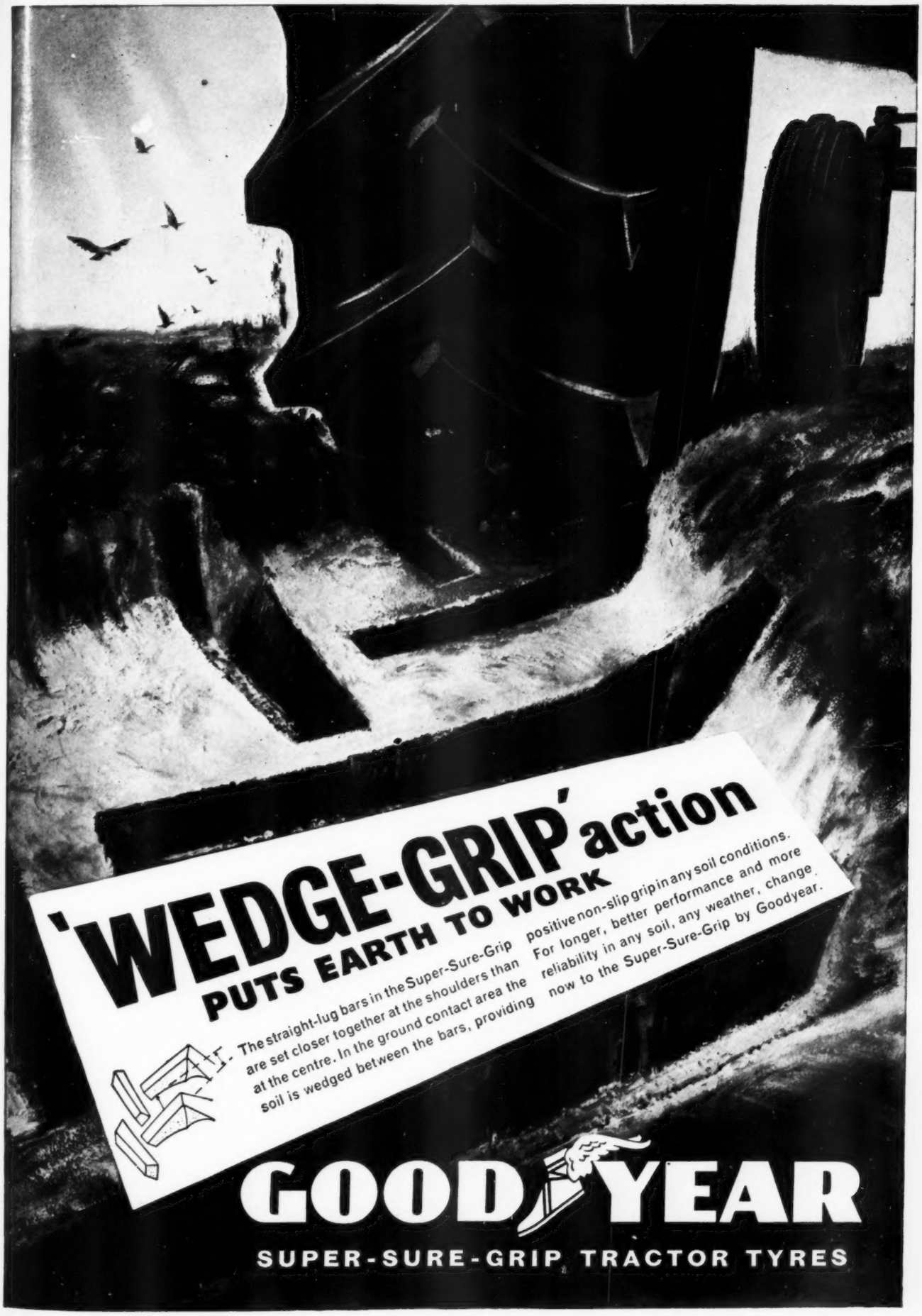
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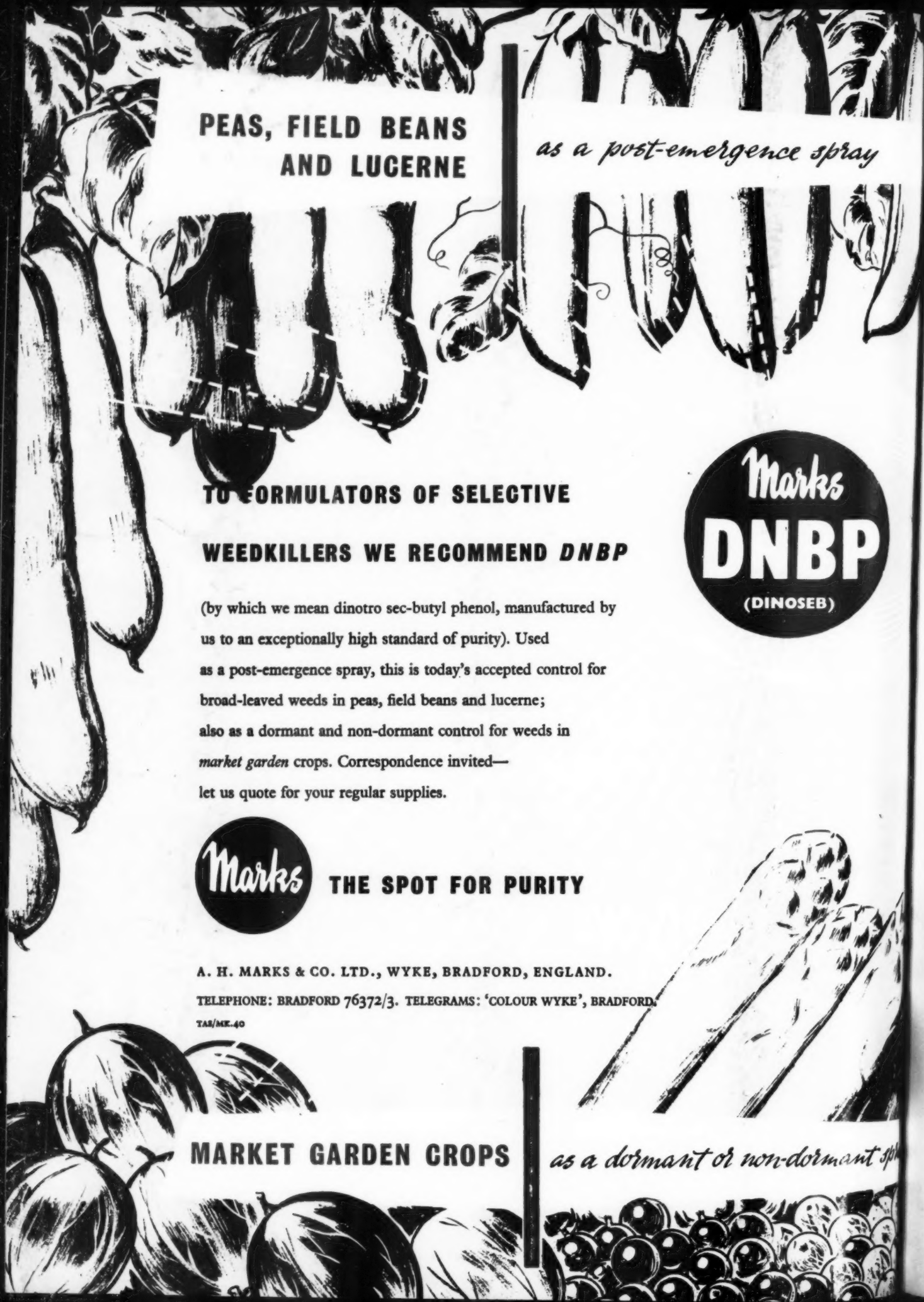

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